



**Division of
Science, Technology
& Innovation**

A Division of Empire State Development

Centers of Excellence

2020 Report

NYSTAR's Center of Excellence Report (FY 2018-2019)

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PROGRAM OVERVIEW AND PURPOSE

Empire State Development's Division of Science, Technology & Innovation (NYSTAR) manages the Centers of Excellence program with a goal of fostering collaboration between the academic research community and business sector to: develop and commercialize new products and technologies; to promote critical private sector investment in emerging high-technology fields in New York State; and to create and expand technology-related businesses and employment. This program was created to enhance and accelerate the university research centers' operations, facilitating joint university-industry research and development, product commercialization and workforce training.

The information is layout in the following categories:

- Importance to NYS
- Impacts
- Designations and Recognitions
- Operating Budget
- Capital Expenditures
- Commercialization Capabilities and Competencies
- New Products or Processes
- Start-ups Formed
- Licensing Agreements

**Center of Excellence for Food and Agriculture at Cornell AgriTech
Cornell University**

Executive Director Catharine Young

Technology Focus:

Commercialization of innovative techniques to improve agriculture and environmental health, as well as, digital agriculture technology, including sensors, robotics, unmanned aviation systems, communication systems, artificial intelligence, block chain and other advanced systems. Commercialization of food and beverage products, especially those developed in conjunction with the Cornell Food Venture Center and the Cornell Pilot Plant. Cutting edge food production processes and product development are prioritized with a goal of scaling-up companies.

Importance to NYS:

The significance of food and agriculture to New York State's economy cannot be overstated. The annual economic impact is approximately \$42 billion. New York is home to more than 33,000 farms which produce a wide variety of agricultural products, and the state is a leader in many farm commodities. According to the USDA, NYS has 2,573 food and beverage processing plants, and food and beverage manufacturers and suppliers are major employers and generators of income for workers, farmers, communities, and state coffers. Cornell provides global leadership in the food and ag sectors, and commercialization of Cornell research and services will continue to grow the New York State economy, provide practical innovations and solutions to farmers, launch new products, and increase food safety. The Center of Excellence for Food and Agriculture at Cornell AgriTech ("CoE" or "the Center") is a new entity that began operations in 2018, and the director was hired in March of 2019. Despite its recent inception, the Center assisted 48 companies during the 07/01/2018-06/30/2019 reporting period, including helping to establish four startups. Through CoE services, several companies realized positive economic impacts that resulted in new and retained jobs, increased revenues, and significant federal and private investment. In 2020, the CoE engaged with 138 businesses.

Purpose

The CoE is a business development hub that provides vision and leadership to advance economic development and connects businesses and entrepreneurs to the resources they need to grow and thrive. The Center's strategic vision is to push innovative, high growth startups to launch their businesses in NYS and commercialize new products, pull companies into New York by linking them with innovation resources and economic development partners, and grow NYS businesses by helping them engage with the research and technical assistance that they need to be successful. The CoE provides business mentoring and connects startups and existing food, beverage and ag tech companies to Cornell research and product development services, business to business partnerships, government funding and incentives, capital resources, and distribution systems.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	12.5	0	\$335,700	\$0	\$475,000	\$387,800	\$637,847	\$1,836,347

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	None			

Operating Budget

2018-2019		Matching Funds		
Operating Budget Description	NYSTAR Funding	Company Cost Share	Other Sources	Total Budget
Salaries & Fringe	\$477,414	\$0	\$320,745	\$0
Indirect Costs	\$71,612	\$0	\$48,112	\$0
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$56,474	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$50,000	\$0	\$0	\$0
Subcontractors	\$236,000	\$0	\$0	\$0
Other	\$108,500	\$0	\$0	\$0
Total	\$1,000,000	\$0	\$368,857	\$0

** Cornell C180179 was not executed until 6/17/19.

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
NONE	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

The CoE is a partner with the Cornell Food Venture Center and its Pilot Plant. The Cornell Food Venture Center helps food businesses large and small introduce new food products into the marketplace by providing educational materials, workshops and direct assistance with product safety evaluation, process development and guidance in local, state, and federal regulatory compliance. The Pilot Plant is a unique processing facility designed for food businesses of all sizes to facilitate product development and scale up new or optimized food products. The Pilot Plant provides the facilities and experience to help clients develop product formulations that scale, create robust production methods and ensure long-term food safety. While the Cornell Food Venture Center supplies the technical food development services to hundreds of clients annually, the CoE provides business development and mentoring services to many of these food and beverage companies to help them scale up their operations, grow jobs and increase their markets.

The CoE is a gateway for companies to Cornell research in many key areas, including digital agriculture, soil health, plant proteins, and emerging crops such as hemp. The Center connects member companies with potential research and development partners at Cornell, and the CoE is

establishing a matching grants program to provide funds for Cornell research that will benefit early-stage startups.

Grow-NY is another CoE partner and several of the finalist companies have received mentorship services before and during this global business competition. When the competition ends, the involvement of the CoE continues to help them succeed in NYS, and several Grow-NY companies have seen positive growth due to the services of the Center.

The CoE works closely with the business development and partnerships arm of the Cornell School of Integrative Plant Science (SIPS). Areas of focus include horticulture, plant biology, plant breeding and genetics, plant pathology and plant-microbe biology, and soil and crop sciences. As a result, the SIPS program has referred several companies to the Center of Excellence for business development services.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
N/A					

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
07/01/2018-06/30/2019	Bright Citizen	New York, NY	Coffee and saffron product	consumer food goods
07/01/2018 - 06/30/2019	Foodful	New York, NY	Ag tech - cloud-based management systems for farmers	agriculture
07/01/2018 - 06/30/2019	Butter Meat Company	Pavilion, NY	Beef	consumer food goods
07/01/2018 - 06/30/2019	Woah! Brands	Ithaca, NY	hemp infused carbonated beverage	consumer food goods

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
N/A			

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

Cornell has established Hydroponics, Aquaculture, Aquaponics Learning Labs to promote STEM education at the Food and Finance High School in Manhattan. Renowned Cornell scientist Philson A.A. Warner has spent more than four decades inventing and developing cutting-edge technologies to produce cleaner and safer foods. The CoE's Executive Director visited the labs and plans to

explore ways to educate students about careers in food and agriculture through the NYC Cornell University Cooperative Extension and the Cornell Food Venture Center NYC office.

The CoE has a relationship with Jamestown Community College and SUNY Fredonia's incubator facility in Dunkirk to foster careers in food and agriculture and link students and startups to Cornell resources. The CoE plans to develop an internship program that could be integrated with Cornell AgriTech's existing Summer Scholars program, thereby, capitalizing on the resources and mentorship the program offers. Finger Lakes Community College, Monroe Community College and Genesee Community College are all in commuting distance and have degree programs that focus on food and agriculture.

Strategic plan:

The CoE uses a push, pull, grow strategy – push entrepreneurs and startups to establish themselves in NYS, pull companies and technologies into New York from other states and countries with Cornell research as the attractant, and grow existing NYS food, beverage, and agriculture technology companies. The Center has developed strategic collaborations with local and regional economic development partners, including Empire State Development regional directors and staff, NYS Department of Agriculture and Markets, Industrial Development Agencies and county economic development departments, Rochester Institute of Technology Pollution Prevention Institute and Packaging Science Department, Hobart and William Smith Colleges Summer Sandbox Accelerator, University of Rochester CoE for Data Science, NextCorps, FuzeHub, SUNY Cobleskill Center for Agricultural Development and Entrepreneurship, City of Geneva Food and Beverage Consortium, Greater Rochester Enterprise, Cornell Agriculture and Research Technology Park, and the NYS Economic Development Council. The CoE has also developed relationships with industry leaders in the food and agriculture sectors.

Objective:

Push innovative, high growth new startup businesses in the food and agriculture technology space in NYS by:

- a. Identifying technologies and entrepreneurs with commercial potential.
- b. Provide commercialization support in the form of mentorship, workshops, business to business partnerships, introductions to capital sources and potential government incentives and grants.
- c. Connect entrepreneurs and startups to academic researchers to create long-term partnerships.

Pull companies to operate in NYS by using our innovations assets by:

- a. Identifying and cataloging NYS innovation resources that could be leveraged to attract companies.
- b. Work with internal Cornell assets, and industry and economic development partners to identify and lure companies to locate in NY.
- c. Lead NYS agriculture and food innovation promotional campaign to further cement NYS's reputation as a top leader in these sectors.

Grow existing NYS companies by:

- a. Encouraging business to business partnerships
- b. Promoting NYS resources, companies, entrepreneurs, academic researchers.

- c. Connecting companies and entrepreneurs to agriculture and food technology support
- d. Establishing a matching grants program to encourage researcher-industry collaboration.

Governance Structure

The CoE is part of the Cornell College of Agriculture and Life Sciences and operates out of Cornell AgriTech, a preeminent center for agriculture and food research in Geneva, NY. The Center is led by Executive Director Catharine Young who reports to Jan Nyrop, Senior Associate Dean and AgriTech Director.

The CoE is in the process of establishing an advisory board of food and agriculture industry partners and economic developers. This advisory board will meet quarterly to review the CoE's progress, provide insights on strategies and make connections that will benefit its clients.

The Advisory Board will conduct an annual review of the CoE to review metrics and projects to ensure that it is fulfilling its mission.

The Center of Excellence in Precision Medicine and Responses to Bioterrorism and Disasters

New York Medical College
David S. Markenson, MD, MBA

Technology Focus: Precision Medicine and Responses to Bioterrorism and Disasters

Importance to NYS: The Precision Medicine and Responses to Bioterrorism and Disasters ("the Center") is the first civilian resource of its kind in the nation. The Center is a major advance in the fight against chemical and biological terrorism, mass casualty incidents and disasters. The Center's expertise encompasses natural disasters, terrorism, operational and tactical medicine and public health preparedness with a competence in the unique needs of children, persons with disabilities, healthcare systems, and facility preparedness.

Purpose

The Center is a unique and widely sought resource for law enforcement, EMS, fire services, healthcare, public health, business, and education sectors. Offering education and training, structured simulation exercises with feedback, drills and expert consulting.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	0	0	\$0	\$132,000	\$0	\$0	\$0	\$132,000

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	None			

Operating Budget

2018-2019		Matching Funds		
Operating Budget Description	NYSTAR Funding	Company Cost Share	Other Sources	Total Budget
Salaries & Fringe	\$471,901	\$0	\$411,719	\$883,620
Indirect Costs	\$70,785	\$0	\$0	\$70,785
Equipment	\$28,000	\$0	\$338,281	\$366,281
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$25,000	\$0	\$0	\$25,000
Subcontractors	\$105,000	\$0	\$0	\$105,000
Other	\$49,314	\$0	\$0	\$49,314
Total	\$750,000	\$0	\$750,000	\$1,500,000

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Simulands, Inc	\$3,149	\$0	\$0	\$0	\$3,149
Nose Trailers	\$5,766	\$0	\$0	\$0	\$5,766
Laerdal	\$35,592	\$0	\$0	\$0	\$35,592
Total	\$44,507	\$0	\$0	\$0	\$44,507

Commercialization Plan

Center Capabilities and Competencies

The Center of Excellence in Precision Medicine and Responses to Bioterrorism and Disasters at New York Medical College (NYMC) is the first non-military resource of its kind in the nation. The Center is a major advance in the fight against terrorism, including chemical and biological terrorism, multiple casualty incident (MCI), public health emergencies, and natural disaster which taken together are an ever-present threat in today's world. Using this expertise, the Center supports healthcare, business, schools, government, and individuals to be better prepared, respond and recover from these events. In addition, the Center's expertise gives businesses in New York State a unique resource to use and advantage as they enter the emergency preparedness business market and governmental funding opportunities.

This unique Center combines NYMC's globally recognized assets in disaster medicine and medical countermeasures with individualized precision medical strategies. It seeks to translate research findings in order to protect Americans from the threat of catastrophic bioterrorism, mass casualty incidents, public health emergencies, and natural and man-made disasters. The Center's expertise encompasses natural disasters, terrorism, operational and tactical medicine, and public health preparedness with a competence in the unique needs of children, persons with disabilities, and healthcare system and facility preparedness.

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
None					

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
N/A				

Research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
N/A			

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

The Center continued to provide education to student physicians, public health students, allied health students and dental students at New York Medical College. The didactic and hands-on emergency, prehospital and disaster medicine education provided by the Center allows student physicians, dental students and public health students to apply their new clinical skills at hospitals, healthcare institutions, public health departments, and corporations in the Westchester County and New York City area. These students are representative of the over 200 healthcare and public health providers produced by New York Medical College each year, many of which choose to remain in New York.

In addition, the Center continues to provide and develop customized MCI, operational and tactical medicine, trauma, hemorrhage control, and emergency management education for healthcare, EMS, Law Enforcement, Fire Service, Public Health, and Emergency Management. This education leads to workforce development in all these sectors as well as scope and capacity increases for these employees.

Lastly, the Center supports programs at local colleges and schools in Disaster Medicine to stimulate interest in this area of Science and Technology.

Strategic plan

The first non-military resource of its kind in the nation, the Center is a major advance in the fight against chemical and biological terrorism, an ever-present threat in today's world. This unique Center combines NYMC's globally recognized assets in disaster medicine and medical countermeasures with individualized precision medical strategies. It seeks to translate research findings in order to protect Americans from the threat of catastrophic bioterrorism, and natural and man-made disasters. The Center's expertise encompasses natural disasters, terrorism, operational and tactical medicine, and public health preparedness with a competence in the unique needs of children, persons with disabilities, and healthcare system and facility preparedness. Offering education and training, structured simulation exercises with feedback and expert consulting, the Center is a unique and widely-sought resource for law enforcement, EMS, fire services, healthcare, business, and education sectors. Specific elements include:

- Sensory Overload and Sensory Deprivation Training Room
- Simulated Apartment, Criminal Location, and Meth Laboratory
- High Fidelity Human Patient Simulations and Training Mannequins
- Tactical Medical Equipment and Police Simulation Equipment
- Simulated Patient Rooms

The Center annually develops metrics guided by its advisory board and approved by the Director. The metrics focus on the education, drills and analysis that are provided to the sectors served. These metrics are reviewed quarterly against targets and then presented to the Advisory Board.

Governance Structure

The New York Medical College CoE in Precision Responses to Bioterrorism and Disasters is a division of the New York Medical College Center for Disaster Medicine (CDM). CDM is a College level center authorized by the New York Medical College Board of Trustees. Day to day to management rests with the Center's Director. The Director reports to the Dean of the School of Health Sciences and Practice who in turn reports to the Chancellor and Chief Executive Officer, New York Medical College and Provost for Biomedical Affairs, Touro College and University System.

The New York Medical College CoE in Precision Responses to Bioterrorism and Disasters has an Advisory Board comprised of representatives from the sectors served, stakeholders in the community and partners. The Advisory Board provides input on the strategic plan and annual metrics. The Advisory Board also provides input on annual review of the Center's success and achievement of metrics.

Center of Excellence in Advanced and Sustainable Manufacturing
Rochester Institute of Technology
Michael Thurston - Director

Technology Focus: Advanced and Sustainable Manufacturing

Importance to NYS:

The NY State Center of Excellence in Advanced and Sustainable Manufacturing ("COE-ASM" or "the Center") provides technical assistance and technology transfer expertise to New York State manufacturing companies in order to improve the sustainability of their products and processes and enable adoption of advanced manufacturing technologies, thereby, increasing their economic competitiveness and the number of value-added manufacturing jobs in the State. To facilitate this objective, the Center also develops technologies in collaboration with NY State manufacturing companies.

Purpose

The research and development focus of the Center includes: 1) reducing manufacturing energy intensity; 2) product design improvement including reducing product material and energy intensity over the life-cycle; and 3) developing advanced manufacturing process technologies to improve product and process efficiency and effectiveness. Activities include, applied research to address common technology problems, supply chain integration, comprehensive metrics for sustainable manufacturing, technology proof of concept demonstration and evaluation, and technology deployment and commercialization support. Deployment activities include but are not be limited to: licensing of technology that results from research; technical and economic assessments for candidate technologies; and technical training (e.g., training in sustainable design, manufacturing readiness, digital manufacturing).

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	33	33.5	\$2,787,086	\$95,000	\$1,923,752	\$3,167,599	\$355,325	\$8,328,762

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

The Center remained very engaged in Manufacturing USA activities and in trying to bring that expertise and funding opportunities to New York companies. Center Director, Dr. Michael Thurston, continued his participation on the Executive Committee of MxD (formerly the "Digital Manufacturing and Design Innovation Institute" or "DMDII") and the Center's program manager, Dr. Mark Krystofik, served on the MxD Technical Advisory Committee (TAC). Dr. Thurston is also the leader of the remanufacturing technology node of the REMADE Institute located in Rochester, NY, and served on the REMADE Strategic Advisory Committee, with Dr. Krystofik serving on the REMADE TAC.

**Operating Budget
2018-2019**

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$821,869	\$55,739	\$195,452	\$1,073,060
Indirect Costs	\$123,280	\$8,361	\$23,762	\$155,403
Equipment	\$5,000	\$	\$18,405	\$23,405
Materials & Supplies	\$25,000	\$3,743	\$903	\$29,646
Tuition	\$0	\$0	\$36,043	\$36,043
Travel	\$5,000	\$569	\$3,844	\$9,413
Subcontractors	\$7,500	\$0	\$0	\$7,500
Other	\$12,351	\$20,900	\$336,552	\$369,803
Total	\$1,000,000	\$89,312	\$614,961	\$1,704,273

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
N/A	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

The COE-ASM commercialization plan considers four primary commercialization pathways:

- Identify and apply under-utilized technologies to resolve specific business challenges faced by NY State manufactures - this may include established and emerging technologies.
- Research and develop new technologies that advance the state of the art in Advanced and Sustainable Manufacturing, and license technologies that have unique intellectual property (IP) and/or disseminate the findings more broadly. The Center puts a priority on licensing and dissemination within NY State.
- Work with specific NY State companies to design and develop product and process technologies that address a particular product or manufacturing opportunity or challenge and facilitate adoption of the technology within the company while considering other broader license opportunities for Center developed IP.
- Provide support to companies to get new technologies ready for commercialization – this includes working with start-ups and existing manufacturers to address technology and manufacturing readiness challenges.

Actual or anticipated new products or processes with commercial application

It should be noted that not all technologies developed by the Center are patentable. A number of projects were focused on developing practical and manufacturable implementations for clients' previously registered patents. Those patents are listed below. The primary COE-ASM staff contributors to the technology development/ commercialization are listed in the Description

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column. COE-ASM also developed technologies with and without company partners or commercial application. These are listed in the second table provided below.

Reporting Period	Patent Name	Inventor	Patent Number	Description
2018-2019	Mop Holder	Client: Ruben Dario Reyes	Client Patent # US2016013565 8A1	Using client existing patent, generated a manufacturable design for commercialization for client
2018-2019	Solar energy system	Client: Jay D. Fischer	Client Patent # US2020005264 6A1	Using client existing patent, generated a manufacturable design for commercialization of integrated cooler for PV solar panel for client
2018-2019	Frameless supplemental window for fenestration	Client: Ronald M. Wexler	Client Patent # US10501981B2	Using client existing patent, generated design modifications to resolve structural problems in support of commercialization for client

Reporting Period	Technology Developed	Project Lead	Project Co-Lead	Description
2018-2019	Test system for qualification of utility gas line flow sensors	Mark Walluk	N/A	Design for unique test system
2018-2019	Energy Harvesting Circuit for Wireless Sensor	Chuck Faisst	Christopher Piggott	Developed system for energy harvesting for wireless energy monitoring system for manufacturing equipment, using current transformer (CT) on equipment power line or PhotoVoltaic generator

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
2018-2019	N/A			

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner. Not all sponsored research agreements result in patentable technologies; therefore, IP ownership or license agreements may not be applicable. Projects under a research agreement sponsored by companies during the reporting period are listed below with the IP in place of the "Inventor" and the partner or sponsoring company in place of the "Licensing Partner."

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Reporting Period	Project	Inventor	Licensing Partner
2018-2019	<i>Sponsored Research: OTM Reformer Reliability Testing Continuation Phase III</i>	Mark Walluk	Praxair Technology
2018-2019	<i>Sponsored Research: Thermal-PV Panel Connector and Adhesive Analysis</i>	Brandon Baker	Tyll Solar
2018-2019	<i>Sponsored Research: Thermal-PV Panel Design for Manufacture</i>	Brandon Baker	Tyll Solar
2018-2019	<i>Sponsored Research: CAD Modeling</i>	Mark Walluk	Enetics Inc.
2018-2019	<i>Sponsored Research: Advanced Manufacturing Technology Awareness & Application</i>	Mark Krystofik	The Gunlocke Company
2018-2019	<i>Sponsored Research: Demand Reduction Investigation for Centrotherm Eco Systems</i>	Marty Schooping	Centrotherm
2018-2019	<i>Technology licensed via RIT Assigned Project Agreement: High Performance Imaging of 3D Objects (COE-ASM and Company Funded)</i>	Ray Ptucha	Kodak Alaris
2018-2019	<i>Sponsored Research: Improved Crack Detection in Lycoming Cases</i>	Kristen Schipull	Penn Yann Aero
2018-2019	<i>Sponsored Research: Manufacturing Engineering Support for New Facility-Manufacturing Operations Layout Development</i>	Gerald Hurley	Re-Nuble Inc.
2018-2019	<i>Sponsored Research: Product Design Engineering Support for Mop Holder Patent Commercialization</i>	Gerald Hurley	RS Clean Lift Corp
2018-2019	<i>Sponsored Research: Manufacturing Engineering Support for In-Plant Operations Expansion and Plant Layout Improvements</i>	Gerald Hurley	Unistel Industries
2018-2019	<i>Sponsored Research: Remanufactured Office Furniture, a Case Study in Additive Manufacturing</i>	Allen Luccitti	Davies Office
2018-2019	<i>Sponsored Research: ERP Evaluation Assistance</i>	Scott Nichols	Pine Ridge Industries
2018-2019	<i>Sponsored Research: Electrical Testing of 10KW DC-DC Bi-Directional Converter</i>	Chuck Faisst	Combined Energies
2018-2019	<i>Sponsored Research: Investigation of Instrumentation for UltraForm Polishing Feedback</i>	Allen Luccitti	OptiPro Systems
2018-2019	<i>Sponsored Research: SteriSpace Design for Manufacturing</i>	Mark Walluk	You First Services
2018-2019	<i>Sponsored Research: Corner Mounting Tab Analysis</i>	Brandon Baker	WexEnergy
2018-2019	<i>Sponsored Research: Factory Visibility Strategy Development and Documentation</i>	Chris Piggott	HP Hood

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

2018-2019

Outreach to build awareness and understanding of advanced and sustainable production continued with tours of the GIS facilities, including tours for the following:

- 15 students and their family members toured GIS as part of RIT's Brick City Homecoming Weekend on October 19, 2018;
- 32 mechanical engineering students toured GIS, specifically the additive manufacturing capabilities on November 14, 2018;
- 16 students and 3 teachers from the World of Inquiry School toured GIS on December 5, 2018;
- 2 junior high school students toured GIS on December 17, 2018;
- 17 students from the undergraduate sustainable development course through the College of Liberal Arts at RIT on March 28, 2019;
- 60 fifth-grade students and five teachers from the World of Inquiry School in Rochester on May 29, 2019;
- 40 fourth-grade students and four teachers from the Marcus Whitman Central School in Rochester on June 14, 2019;
- 14 students from various Rochester high schools as part of a Clean Energy Summer Workshop on July 10, 2019;
- 14 teachers from various Rochester-area high schools on July 25, 2019.

Monroe Community College (MCC)

- COE-ASM continues to collaborate with Dr. Todd Oldham, MCC Vice President, Economic Development and Innovative Workforce Services, who is leading REMADE Institute workforce development activities.
- Dr. Mike Thurston also participated in a steering committee for a new Advanced Manufacturing program that MCC is developing.

Strategic plan

Overview

The NY State COE-ASM will develop technologies in collaboration with NY State manufacturing companies to help make their products and processes more sustainable and therefore more competitive, and to increase the number of value-added manufacturing jobs. The research and development focus of the Center includes: 1) reducing manufacturing energy intensity; 2) product design improvement including reducing product material and energy intensity over the life-cycle; and 3) developing advanced manufacturing process technologies to improve product and process efficiency and effectiveness. Activities include applied research to address common technology problems, supply chain integration, comprehensive metrics for sustainable manufacturing, technology proof of concept demonstration and evaluation, and technology deployment and commercialization support. Deployment activities include but not be limited to: licensing of technology that results from research; technical and economic assessments for candidate

technologies; and technical training (e.g., training in sustainable design, manufacturing readiness, digital manufacturing).

Strategy

The Center will focus on activities that promote increased federal funding for Advanced and Sustainable Manufacturing in NY State and that directly enhance the competitiveness of NY State companies resulting in economic growth in the State. Specific strategies that will be employed include:

- Strengthen and build relationships with industrial partners.
- Develop/maintain a diverse and highly qualified advisory board.
- Partner/collaborate with existing programs to facilitate outreach and marketing.
- Support/advance growth of existing NY State clusters including Energy Storage and Food Processing.
- Engage in Manufacturing USA institutes in aligned technology areas.
- Identify opportunities for new company creation or existing company job creation to support smart products and systems, or provide value added sustainability services to industry.

Governance Structure

COE-ASM is governed by the terms of the contract between NYS Department of Economic Development and RIT. RIT's Sponsored Research Services and Sponsored Program Accounting departments ensure contractual and financial compliance respectively.

COE-ASM is led by its Director, Dr. Michael Thurston. Dr. Thurston is engaged in development and outreach, over-all program leadership, project review, and educational activities. He is responsible for developing relationships with other CAT and COE Centers in NYS as well as national initiatives, such as engagement in the Manufacturing USA Institutes. Dr. Thurston is responsible for ensuring the Center goals and contractual requirements are met, including progress and metrics reporting, effective allocation of state funds, and cost share requirements. Dr. Thurston reports organizationally to GIS Director, Dr. Nabil Nasr.

COE-ASM is advised by an industry advisory board led by Dr. Nasr. The board consists of a cross-section of business leaders from different types of commercial ventures, as well as representation from Empire State Development's NYSTAR division. Advisory Board members include (as of December 31, 2020):

- *Mike Bechtold, President, OptiPro*
- *Arunas Chesonis CEO, Sweetwater Energy, Inc.*
- *Judith Tholl, University Relations Manager, Empire State Development*
- *Bruno Glavich, Founder, CEO and President, Applied Image Group, Inc.*
- *Dick Kaplan, CEO, Torvec, Inc.*
- *Christine Whitman, Chairman, CEO & President, Complemar*
- *John Batiste, President and CEO, Buffalo Armory LLC*

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- *Nabil Nasr, Ph.D., Chairman of COE-ASM Advisory Board, Associate Provost for Academic Affairs, and Director GIS*

The function of the board is to provide a review of Center progress and advise the leadership regarding strategy and new ideas to achieve its goals.

**COE in Weather and Climate Analytics
University at Albany**

**Dr. Chris Thorncroft, Director
Jan Timothy Woodcock, Director of Operations**

Technology Focus: Weather and Climate Analytics, Artificial Intelligence (AI), Machine Learning, Big Data, Virtual Reality, etc.

Importance to NYS:

The Center of Excellence in Weather and Climate Analytics ("COE" or "the Center") is New York State's entrepreneurial hub for a network of over 120 weather and climate faculty, researchers and research staff based at UAlbany. Together, these experts are deeply engaged in advancing innovative weather and climate research applications with a variety of New York based industries representing utilities, agriculture, renewable energy, emergency management, transportation, agriculture, finance, insurance, healthcare, tourism, and Unmanned Aerial Systems, to name a few.

The Center involves the Atmospheric Science Research Center (ASRC), the Department of Atmospheric and Environmental Science (DAES), the NYS Mesonet, the Calibration Laboratory, the Whiteface Mountain Observatory, and the xCITE Lab (a state-of-the-art data and visual analytics center). These organizations connect atmospheric science research and applications with emerging technologies – such as artificial intelligence (AI) and machine learning, data analytics, virtual reality, and application development to support the growth of the NYS economy.

The Center is focused on high impact weather monitoring and prediction research and commercialization aimed at better understanding the causes of high impact weather in New York State as well as the kinds of changes expected in the future as a result of climate change. In collaboration with strategic partners, the Center improves New York State's resilience in the face of high impact weather events.

Purpose

The purpose of the Center is to develop and expand New York State's economic development. This includes: (1) driving growth in commercial revenue and jobs from small start-ups as well as large commercial enterprises; (2) increasing competitively awarded research and development grants; and (3) increasing collaborations with faculty and the private sector. The COE pursues a multidisciplinary economic development strategy that reaches the sectors of energy, agriculture, transportation, forensics (insurance), health, tourism, and finance/commerce.

The COE is driving an effort to empower Governor Cuomo's CLCPA (Climate Leadership and Community Protection Act) and the Energy Industry of the future. The COE is critical to the Energy Industry of the future in the face of a changing climate and our transition to clean energy. The Center is developing leading energy industry-academia partnerships to advance weather research and AI technologies to continually improve the Energy Industry's efficiency and reliability. The COE envisions a "Weather Energy Industry-University Hub" at the UAlbany ETEC Complex, which will be opened in the summer of 2021.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	2	1	\$923,496	\$192,000	\$0	\$700,000	\$0	\$1,815,496

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

Operating Budget

2018-2019		Matching Funds		
Operating Budget Description	NYSTAR Funding	Company Cost Share	Other Sources	Total Budget
Salaries & Fringe	\$147,497	\$0	\$0	\$147,497
Indirect Costs	\$22,125	\$0	\$0	\$22,125
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$18,178	\$0	\$0	\$18,178
Subcontractors	\$0	\$0	\$0	\$0
Other	\$62,200	\$0	\$250,000	\$312,200
Total	\$250,000	\$0	\$250,000	\$500,000

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
N/A	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

The Center has a robust cadre of associated faculty and staff who have skills and expertise to address most atmospheric sciences research problems. Like how the weather (atmospheric sciences) affects nearly every sector, the Center is forming relationships with nearly every academic department at the University at Albany. The University employs key opinion leaders in Atmospheric Sciences, Business, Transportation, Public Policy, Actuarial Sciences, Public Health, Computer Sciences and Engineering. The Center and associated faculty have wide-ranging weather expertise that is applicable to solving problems across many sectors.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Patent Number, New Tech RF No.	Description
2018-2019	Weather Risk Assessment Tool	Dr. Nick Bassill	SUNY RF Case No. for the invention is 010-19-10	The tool is being used by BOCES, DOT, All NYS Utilities, and most SUNY campuses to understand and manage operations for weather events. The tool is able to predict weather at a very localized scale and apply risk factors to events such as hail, sleet, and snow.
2018-2019	xCITE Mobile App	Dr. Kara Sulia	SUNY RF Case No. for the invention is 010-19-01	The "xCITE Mobile App", a mobile phone application delivering interactive access to the NYS Mesonet and Weather Reporting

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
N/A				

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor, PI	Licensing Partner, Partner
2018-2019	Perfect Forecast	Dr. Richard Perez	Clean Power Research
2018-2019	Development of a weather-based power outage prediction tool	Dr. Nick Bassill	CHG&E
2018-2019	Development of Wind Extremes Forecast System	Dr. Jeff Freedman	Con Ed
2018-2019	Effects of Climate Change on Renewable Energy Distribution in NYS Award	Dr. Jeff Freedman	UL Renewables
2018-2019	Advanced Solar Forecasting & Load	Dr. Richard Perez, Dr. Jerry Brotzge, Jan Timothy Woodcock	Electric Power Research Institute (EPRI)
2018-2019	Unmanned Aerial Systems	Dr. Kara Sulia	TruWeather Solutions

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2018-2019	Advanced Solar Forecasting & Load	Dr. Richard Perez, Dr. Jerry Brotzge, Jan Timothy Woodcock	Brookhaven National Laboratory (BNL)
2018-2019	Effects of Climate Change on Renewable Energy Distribution in NYS	Dr. Jeff Freedman	Mano Nano Technologies (MNT)
2018-2019	Development of Wind Extremes Forecast System	Dr. Jeff Freedman	MESO

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

STEP (Science and Technology Entry Program)

The Center provides support for undergraduate research in the STEP program. The STEP prepares historically underrepresented and economically disadvantaged elementary and secondary school students to acquire the aptitude and skills necessary to pursue post-secondary degree programs that lead to professional careers in the scientific, technical, health-related or other licensed professions.

K-12 Education Programming

The Center helps to promote STEM education at local schools by supporting elementary trips to NYS Mesonet weather stations where students engage in a hands-on learning experience while being taught by University at Albany atmospheric sciences faculty. Additionally, elementary school students are invited on an annual basis to visit the University's Atmospheric Sciences Research Center where students learn about weather modeling, forecasting, instruments, and get to watch a weather balloon launch.

Girls Inc.

The Center helps to promote STEM education through our Girls Inc. program, hosting nearly 20 girls.

Strategic plan

UAlbany's COE in Weather and Climate Analytics strategic plan is to grow as NY State's entrepreneurial hub for advancing innovative weather and climate research applications with scores of New York companies based in industries representing utilities, agriculture, renewable energy, emergency management, transportation, agriculture, finance, insurance, healthcare, tourism, and Unmanned Aerial Systems.

The Center will increase atmospheric science research and applications connections with emerging technologies – such as AI and machine learning, data analytics, virtual reality, and application development to support the growth of the NYS economy. The Center will focus on high impact weather monitoring and prediction research and commercialization aimed at better understanding the causes of high impact weather in New York State as well as the kinds of changes expected in the future as a result of climate change. In collaboration with strategic partners, the Center improves New York State's resilience in the face of high impact weather events.

Strategy:

The strategic purpose of the Center is to develop and expand New York State's economic development. This includes: (1) driving growth in commercial revenue and jobs from small start-ups as well as large commercial enterprises; (2) increasing competitively awarded research and development grants; and (3) increasing collaborations with faculty and the private sector. The COE pursues a multidisciplinary economic development strategy that reaches the sectors of energy, agriculture, transportation, forensics (insurance), health, tourism, and finance/commerce.

The Center will:

1. Establish and maintain a robust leadership team.
2. Establish and maintain a team of scientific researchers.
3. Identify and develop collaborations with industry sectors to develop projects addressing high impact weather related risks.
4. Leverage Federal and State funding in support of applied research to advance workforce development in support of the weather and climate analytics marketplace.

The COE is driving an effort to empower Governor Cuomo's CLCPA (Climate Leadership and Community Protection Act) and the Energy Industry of the future. The COE is critical to the Energy Industry of the future in the face of a changing climate and our transition to clean energy. The Center is developing leading energy industry-academia partnerships to advance weather research and AI technologies to continually improve the Energy Industry's efficiency and reliability. The Center envisions a "Weather Energy Industry-University Hub" at the UAlbany ETEC Complex which will be opened in the summer of 2021.

Governance Structure

UAlbany's COE in Weather and Climate Analytics governance structure is driven by the needs of its numerous commercial partners. The Center actively communicates with its partners and also manages numerous collaborative research projects and other related investments. The COE has two advisory boards, our Industry Advisory Board made up of Industry Leaders and our UAlbany Executive Advisory Board made up of internal executives. The COE is overseen by the UAlbany Vice President of Research, Dr. James Dias. Dr. Chris Thorncroft is the Director, Jan Woodcock is the Director of Operations, and Dr. Nick Bassill is the Director of R&D. The Center utilizes a program management approach to govern its numerous projects and partners.

Small Scale Systems Integration and Packaging Center
State University of New York at Binghamton
Bahgat Sammakia, PhD

Technology Focus: Electronics and Energy Storage Manufacturing

Importance to NYS:

Electronics and energy storage are technically complex, high value manufacturing activities, aligned with the strongest growth sectors of global, national and regional economy. These industries bring well-paying jobs to New York and require a well-educated, skilled workforce, and offer meaningful jobs and career growth paths for workers, opportunities for retention of new college graduates, attraction of skilled professionals from out of state, and contribute to a high quality of life for the people of New York.

Purpose

The Small Scale Systems Integration and Packaging Center of Excellence ("S3IP" or "the Center") provides a dedicated building for center staff, laboratories and associated interactions with the industry. The Center is an umbrella organization comprising of six (6) distinct research centers and seven (7) laboratories. The labs are equipped with instruments for physical characterization of materials, surfaces, interfaces, and manufactured electronic devices and batteries. Labs are operated by professional doctoral-level staff or faculty. All labs are available for, and actively used, in support of industrial research projects and problem solving assisted by the professional staff.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	1	6	\$650,000	\$4,150,000	\$750,000	\$2,585,000	\$510,000	\$8,645,000

Designations and Recognitions

Year	Awards/ Recognition	Date Received	Recipient	Recognizing Organization	Link
2018-2019	Turnbull Lecture Award	Nov. 28, 2018	Prof. M. Stanley Whittingham, Chemistry	Materials Research Society	https://materials.typepad.com/mrs_meeting_scene/2018/11/stanley-whittingham-2018-mrs-david-turnbull-lectureship-award-winner.html
2018-2019	Innovation Award	Dec. 16, 2018	Prof. M. Stanley Whittingham, Chemistry	Materials Today	https://www.materialstoday.com/energy/news/2018-innovation-award-winner-announced/
2018-2019	Sproule Lectureship	2018	Prof. M. Stanley Whittingham, Chemistry	Cornell University	https://www.ccmr.cornell.edu/industry/ccmr-symposium/2019-symposium-recorded-talks/

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Designations and Recognitions, Continued					
Year	Awards/ Recognition	Date Received	Recipient	Recognizing Organization	Link
2018-2019	iMAPS Outstanding Educator Award	Oct. 2018	Benson Chan, Assoc. Director, IEEC	iMaps	https://www.imaps.org/society_ award_winner_history.php
2018-2019	Associate Editor	Jan. 2019	Prof. Pritam Das, Electrical and Computer Engineering	IEEE Transactions on Industrial Electronics	https://www.binghamton.edu/ne ws/story/1565/faculty-named- associate-editor-of-prestigious- ieee-journal
2018-2019	Individual Development Award	May 2019	Prof. Jia Deng, Systems Science and Industrial Engineering	New York State/United University Professions Joi nt Labor- Management Committees (NYS/UUP JLMS)	
2018-2019	President of the Executive Council of Alpha Pi Mu	July 2018	Prof. Sarah Lam, Systems Science and Industrial Engineering	Alpha Pi Mu	https://alphapimu.com/executiv e-council/
2018-2019	IISE New Faculty Colloquium	May 2019	Prof. Fuda Ning, Systems Science and Industrial Engineering	Institute of Industrial and Systems Engineers (IISE)	https://www.binghamton.edu/ne ws/story/2078/2018-19-awards- and-accolades-for-systems- science-and-engineering- department
2018-2019	Diplomate of the Society for Health Systems (SHS), a division of the Institute of Industrial and Systems Engineers (IISE)	Feb. 2019	Prof. Mohammad Khasawneh, Systems Science and Industrial Engineering	Society for Health Systems (SHS), a division of the Institute of Industrial and Systems Engineers (IISE)	https://www.iise.org/SHS/Details .aspx?id=18300
2018-2019	Technology Champion & Leadership in Education Award from FlexTech	Feb. 21, 2019	Prof. Mark Poliks, Systems Science and Industrial Engineering	FlexTech	https://www.semi.org/en/semi- flextech-announces-2019-flexi- awards-winners-flexible-hybrid- electronics

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Designations and Recognitions, Continued					
Year	Awards/ Recognition	Date Received	Recipient	Recognizing Organization	Link
2018-2019	Chancellor's Award - Excellence in Scholarship and Creative Activities	2018-19	Prof. Sangwon Yoon, Systems Science and Industrial Engineering	SUNY Chancellor's Office	https://www.binghamton.edu/academics/provost/excellence-awards/past-faculty-staff-award.html
2018-2019	Graduate Student Excellence Award in Service/Outreach	April 2019	Grascen Shidemantle Biological Sciences	NSF	
2018-2019	William R. & Lenore Mote Eminent Scholar in Marine Biology	April 2019	Prof. Curt Pueschel, Biological Sciences	Florida State University	
2018-2019	Smithsonian Magazine, publication	March 2019	Prof. Steven Tamariello, Biological Sciences	Smithsonian	https://www.smithsonianmag.com/history/scientists-extract-dna-from-seabiscuits-hooves-to-figure-out-how-he-was-so-fast-180970649/
2018-2019	Simberloff Award for Outstanding Presentation in Invasion Biology	March 2019	Carmela Buono, Biological Sciences	Ecological Society of America conference, featured in the Journal of Biological Invasions	https://link.springer.com/article/10.1007/s10530-018-1877-y
2018-2019	NYS/UUP Individual Development Awards (IDA)	May 2019	Prof. Jia Deng, Systems Science and Industrial Engineering		

Operating Budget

2018-2019		Matching Funds		
Operating Budget Description	NYSTAR Funding	Company Cost Share	Other Sources	Total Budget
Salaries & Fringe	\$746,850	\$264,829	\$567,804	\$1,579,483
Indirect Costs	\$112,028	\$35,611	\$82,395	\$230,034
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$12,829	\$103,482	\$116,311
Tuition	\$0	\$24,049	\$28,963	\$53,012
Travel	\$5,000	\$9,967	\$135,367	\$150,334
Subcontractors	\$0	\$0	\$105,139	\$105,139
Other	\$136,122	\$708	\$34,424	\$171,254
Total	\$1,000,000	\$347,993	\$1,057,574	\$2,405,567

2018-2019 Total Federal: \$672,404

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
N/A	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

The S3IP provides laboratory capability and expertise that assists companies with problem solving and manufacturing processes for their electronic products. The Center offers design investigation and optimization, prototype manufacturing, failure analysis, reliability improvement, and performance testing for electronic systems and advanced Li-ion batteries. Key technologies being advanced for products and processes on behalf of industrial clients include: thermal management for electronics; electronic manufacturing materials characterization including solder and heat transfer compounds; prototyping of AI-assisted surface mount (SMT) electronics manufacturing processes; hybrid flexible electronics materials and manufacturing processes; heterogeneous integration design and thermal management; energy efficiency design and management techniques for large scale electronic systems (data centers); liquid and two-phase heat exchanger technology for cooling of high power electronics; materials and process for thin-film deposition of electronics materials for solar cells and supercapacitors; and advanced materials, design, prototyping, and performance analysis of Li-ion batteries.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
2018-19	Apparatus and method for efficient estimation of the energy dissipation of processor based systems	Kanad Ghose		10,289,185	This invention monitors data center workload and based on usage patterns makes predictions about future workload, enabling lightly loaded servers to be turned off, and additional server capacity to be turned on and brought online in anticipation of near term increases in workload demand.
2018-19	New Method for Fabricating monodispersed Fe Oxide@Au nanoparticles in the range of 5-100 nm	Hye-Young Park	Chuan Jian Zhong	10,191,042	Nanoparticles exhibit intriguing changes in electronic, optical and magnetic properties as a result of the nanoscale dimensionality. The ability to engineer uniform size distribution is essential for the exploitation of these properties. The preparation of magnetic nanoparticles and nanocomposites in particular has attracted both fundamental and practical interest because of potential applications in areas such as ferrofluids, medical imaging, drug targeting and delivery, cancer therapy, separations, and catalysis. Gold coating on magnetic particles provides an effective way to impart magnetic particles with the desired chemical or bio-medical properties. However, many of the magnetic core or shell dimensions have been limited to <15 nm. This limitation poses a serious barrier to magnetic applications where the size tunability, especially in larger sizes (up to ~100 nm) with sufficient

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					magnetization, is required. This invention comprises a method to build up larger sized magnetic particles via a constructing a shell of particles around a central core. The method allows the particle size to be tuned and offers high uniformity in particle size. It uses a thermal fabrication approach to create ligands that bind the particles together in a shell.
2018-19	Pastes for Thermal, Electrical and Mechanical Bonding	Bahgat Sammakia	Hao Wang	10,308,856	In an electronic assembly, heat from the active components, such as integrated circuits is dissipated directly to the air by convection and radiation, and to heat sinks and other cooling apparatus via conduction. Each interface in the thermal path creates resistance to heat flow. This thermal resistance can be reduced by use of a thermal interface material (TIM) that assures good contact between the mated components. Metals in general have very good properties for thermal conduction, but do not have sufficient compliance to serve as a good TIM except under special conditions. This invention employs composite silver, copper, or other metal or alloy nanomaterials in the composition of the TIM formulated as a paste. The electronics industry used TIM pastes today, but these are typically different types of grease; this invention greatly increases the thermal conductivity of paste-like TIMs.

Start-up Companies Formed

No start-up companies were formed during this period.

Reporting Period	Company Name	City	Product/Service	Sector
N/A				

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor/ Primary Investigator (PI)	Licensing Partner/Sponsor
2018-2019	Engineering a Small Intestinal Microbiome to Evaluate Food Additive Exposure (Award 81858)	PI: Prof. Gretchen Mahler, Biomedical Engineering	Sponsor: National Institutes of Health
2018-2019	Manipulating and Exploiting Lattice Strain as a Novel Platform to tenth surface work Function of Metallic Nanocatalysts (Award 81930)	PI: Prof. Jiye Fang, Chemistry	Sponsor: National Science Foundation
2018-2019	Engineering a Kidney Glomerulus and Proximal Tube on a Chip (Award 82279)	PI: Prof. Gretchen Mahler, Biomedical Engineering	Sponsor: Alternatives Research and Development Foundation
2018-2019	Materials Synthesis and Simulations Across Scales (MS3) (Award 82372)	PI: Prof. Guangwen Zhou, Mechanical Engineering	Sponsor: Pacific Northwest National Laboratory
2018-2019	Next Generation HVAC Absorption Compressorless HVAC using Advanced Materials (Award 82746)	PI: Prof. Scott Schiffres, Mechanical Engineering	Sponsor: EthosGen LLC
2018-2019	Binghamton Materials Science Outreach Program (Award 84057)	PI: Prof. M. Stanley Whittingham, Chemistry	Sponsor: Materials Research Society
2018-2019	Capacitive Pressure/Velocity Probe for Acoustic Measurements in Human Ear Canal (Award 84088)	PI: Prof. Ron Miles, Mechanical Engineering	Sponsor: National Institute on Deafness and Other Communication Disorders
2018-2019	I-Corps: Copper-Based Nanowire Pastes for Solar Panels (Awards 84142)	PI: Prof. CJ Zhong, Chemistry	Sponsor: National Science Foundation

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2018-2019	CHIRP: Exploration of Holistic Scaleout Designs within Heterogeneous Packages for HPC/Server Processors (Award 84455)	PI: Prof. Kanad Ghose, Computer Science	Sponsor: Purdue University
2018-2019	CHIRP: Direct Liquid and Two Phase Cooling of High Heat Flux Electronics in Heterogeneous Integrated (HI) Packages: Experimental and Analytical Studies at the Device and Module Level (Award 84458)	PI: Prof. Bahgat Sammakia, Mechanical Engineering	Sponsor: Purdue University
2018-2019	Implementing Business Intelligence and Analytics to Large-Scale Pharmacy Automation Solutions (award 87370)	PI: Prof. Krishnaswami Srihari, Systems Science and Industrial Engineering	Sponsor: Innovation Associates, 711 Innovation Way, Johnson City, NY 13790
2018-2019	Developing Large-scale Pharmacy Solutions Using Discrete Simulations, Data Analytics and Optimization and Systems Engineering Principles (award 84909)	PI: Professors Krishnaswami Srihari and Sangwon Yoon, Systems Science and Industrial Engineering	Sponsor: Innovation Associates, 711 Innovation Way, Johnson City, NY 13790
2018-2019	Automation and Process Improvements in a Contract Manufacturing Company (award 84532)	PI: Professors K. Srihari and Nagendra Nagarur, Systems Science and Industrial Engineering	Sponsor: Sanmina Corp.
2018-2019	Incoming Inspection and Supplier Quality Studies for the Assembly of Complex Data Server Systems (award 85484)	PI: Prof. Daryl Santos, Systems Science and Industrial Engineering	Sponsor: Penguin Computing Incorporated
2018-2019	Research Driven Continual Process Improvement on Complex Surface Mount Device Assemblies and Process Analysis and Improvement for the Assembly of Complex Data Server Systems (awards 85375 and 84916)	PI: Prof. K. Srihari, Systems Science and Industrial Engineering	Sponsor: Smart Modular Technologies Inc.

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2018-2019	Process Improvement for the Assembly of Complex Data Server Systems and Advanced Process Research and Development for Complex Surface Mount Devices Assemblies (awards 85116 and 84917)	PI: Prof. K. Srihari and Prof. Christopher Greene, Systems Science and Industrial Engineering	Sponsor: Smart Modular Technologies
2018-2019	Warehouse Operations Management and Analytics Research and Development (RF award 83825, 86847)	PI: Prof. K. Srihari, Systems Science and Industrial Engineering	Sponsor: Bennet Distribution Services, LLC
2018-2019	Lightweight Hypervisor-Level Mechanism for Guest Security and Reliability (RF award 83683)	PI: Prof Karthik Gopalan, Computer Science	Sponsor: ITRI International Inc.
2018-2019	ICorps: Additive Laser Metal Deposition onto Silicon for Enhanced Electronics Cooling (award 84927)	PI: Prof. Scott Schiffres, Mechanical Engineering	Sponsor: National Science Foundation
2018-2019	Theory-guided discovery of Tin-Based Materials (award 82142)	PI: Prof. Alexey Kolmogoro, physics	Sponsor: National Science Foundation

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

The Integrated Electronics Engineering Center (IEEC), a Center for Advanced Technology under the umbrella of S3IP, sponsored the annual Electronics Packaging Symposium on September 18-19, 2018 at the Innovative Technology Center at the State University of New York at Binghamton. There were 337 people that attended the symposium. Of those, 93 were from New York State industry.

The S3IP took part in the annual BU Day at the Mall on February 23, 2019. The Center set up a display featuring 3D printing. This display is always very popular and draws an audience.

On March 3, 2019, Benson Chan of the IEEC made a presentation on 3D printing at TEDx Binghamton University, about 300 people attended.

Center's staff continue to train students and industry personnel on use of the equipment in the labs. IEEC and Advanced Diagnostic Lab staff documented 64 hours spent on training in the January-June 2019 period.

Strategic plan

1. The broad focus of the Center is support to the electronics manufacturing and advanced energy storage industries in New York via application of university laboratories, skills

(research faculty, professional staff, and graduate students) to generate economic impact. Faculty research activity and contacts with industry is used to inform the long term technical directions and focal areas of the Center, acquisition of instruments, and staff hiring based on industry trends. The Center assists the university in capital investment proposals to local and state economic development agencies including the Southern Tier Regional Economic Development Council (REDC), the Upstate Revitalization Initiative (URI), and Empire State Development (ESD) investments. The Center also assists faculty in pursuit of grants from state agencies such as the New York State Energy Research and Development Agency (NYSERDA).

2. Being a bridge between academia and industry, key S3IP business-oriented performance metrics include the economic impacts reported by industry partners, the quantity of industrial member companies and projects, the level of industrial project activity in the Center's labs, and patent activity. Academically oriented metrics include number of S3IP-affiliated students graduated with MS and PhD degrees and scholarly publication activity for its affiliated faculty and researches.
3. The Center's executive and leadership in key research centers has extensive industrial experience to ensure cognizance and sensitivity to industry expectations. In addition, the Center features an advisory board comprising of senior industry executives and leaders from academia for independent review and advice concerning its performance and strategic directions. The advisory board meets twice annually to review the Center's progress and directions.

Governance Structure

The S3IP's executive director is the university's vice president for research and is responsible for the overall management and strategies of the Center; he is assisted by an associate director responsible for day to day operations, management of the administrative and professional staff, and implementation and evolution of the strategic plan. Each of the six (6) constituent research centers is directed by a tenured faculty member assisted by professional and administrative staff, depending on constituent center size. The S3IP has an industrial advisory board. The Integrated Electronics Engineering Center (IEEC) CAT and FlexMed CAT (part of the Center for Advanced Microelectronics Manufacturing, or CAMM) have industrial advisory boards to review and advise the research center directors. The IEEC utilizes a paid-membership business model. Member companies appoint representatives to the Technical Advisory Board that work with CAT leadership to charter research projects aligned with the interests of industrial member companies and faculty capabilities. The Energy Smart Electronics Systems (ES2) research center also utilizes a paid-membership business model and advisory board structure to define the research project portfolio. The labs are managed directly by S3IP leadership or research center directors.

Center of Excellence Bioinformatics & Life Sciences
University at Buffalo
Dr. Norma Nowak

Technology Focus: Bioinformatics and Life Sciences

Importance to NYS:

The University at Buffalo's (UB) New York State Center of Excellence in Bioinformatics & Life Sciences ("CBLS" or "the Center") leverages the University's expertise and cutting-edge capabilities in genomics, bioinformatics, proteomics, bioanalysis, data analytics, and supercomputing to partner with the industry to drive life sciences innovation and to commercialize new technologies that strengthen the region's and the state's economies.

The Center empowers entrepreneurs to launch new companies, enables the growth of existing firms, and serves to attract relocating and expanding businesses to NYS. The CBLS provides the environment and talent to complete the path from discovery through commercialization in its mission to support and enable the growth of NYS life sciences companies.

Purpose

The CBLS – one of the four original NYS Centers of Excellence designated in 2001, is a hub for the region's growing life sciences industry cluster and supports the entrepreneurial ecosystem while cultivating collaborative opportunities among UB faculty, students, clinician entrepreneurs, and industry partners. Twenty companies, mostly start-ups, are in residence at the CBLS. The Center is a community asset open to those with new ideas looking to engage with university assets and expertise in order to drive innovation through the development of new therapeutics, medical devices, and diagnostics as well as computational resources for data analytics. The CBLS also supports and hosts numerous programs focused on innovation, commercialization, new job creation, company growth, and contributes significantly to the university's translational research, enhancing UB's innovation and economic impact while advancing human health and clinical care.

The following examples highlight the progress for the period from 7/1/18-6/30/19:

- The CBLS technology platforms and experts in genomics, bioinformatics, proteomics, and data analytics laid the foundation for the engagement with ThermoFisher Scientific (Grand Island Facility) as an industry partner utilizing the services offered through the CBLS Core facilities.
- Rheonix, an Ithaca, N.Y. based company, similarly leveraged CBLS faculty expertise and the Center's Genomics and Bioinformatics Core assets towards the development of their new product NGS OnePrep™ Automated DNA Extraction and Library Preparation Solution launched at the Association of Molecular Pathology (AMP) annual conference in November 2018. This product expanded the scope of the Rheonix CARD technology to automatically isolate and purify DNA from a wide spectrum of clinical and nonclinical specimens for subsequent molecular diagnostic testing.

- Athenex continues its rise in the oncology pharmaceutical sector raising \$100 million in capital for further expansion and growth through three institutional investors, Perceptive Advisors, Avoro Capital Advisors and OrbiMed. Investment by three of the leading institutional investors is indicative of confidence in the company and an inflection point in value. Athenex remains a resident at CBLS leveraging the industrial scale chemistry facilities as well as office space while its company headquarters are nearby on the Buffalo Niagara Medical Campus.
- Aesku NY, Inc., co-located in the CBLS since 2014, is set for further expansion and has signed an agreement with Buffalo Institute for Genomics (BIG).
- An example of a research highlight is a project focused on the development of a diagnostic assay predicting, which patients are likely to suffer from statin induced myopathy. The goal of this project is to identify individuals at risk for statin-induced myopathy as well as reduce the economic strain on the patients. This work resulted in a publication entitled “*RYS1* and *CACNA1S* genetic variants identified with statin-associated muscle symptoms” in the journal Pharmacogenomics in October 2018.
- On the technical front, CBLS core facilities have had a successful year with multiple industry sponsored collaborations. The Proteomics and Bioanalysis (PBC) team led by Dr. Jun Qu in collaboration with Roche Pharmaceuticals developed a novel Liquid Chromatography/Mass Spectrometry method to quantify biotherapeutics and biomarkers in plasma and tissues in a high-throughput and sensitive manner. This novel method is valuable to pharmaceutical companies for protein-drug development (published in Journal of Analytical Chemistry in 2019). Dr. Qu has defined methodologies and advanced scientific knowledge in the field of Proteomics that will change the way cancer, infection and heart disease are diagnosed and treated. For his tremendous body of accomplishments, he has been selected to receive the 2019 University at Buffalo Exceptional Scholar Award for Sustained Achievement.
- The Center for Computational Research and the Buffalo Institute for Genomics in partnership with the CBLS Genomics and Bioinformatics Core developed a new software for genome analytics. GenESysV provides a fast, intuitive and scalable genome exploration open source tool to detect gene mutations generated from high-throughput sequencing projects (published in BMC Bioinformatics in 2019).

Of the 20 companies located within the CBLS during the reporting period, five of them previously or currently benefit from UB CAT matching grants to support applied research projects with UB faculty. Also, 13 of the companies located at the CBLS benefit from participation in the Start-up NY program.

Athenex, CH3 and Neurovascular Diagnostics are UB licensees/startups.

- Aesku NY, Inc.*
- AHRM, Inc.
- Align Starpro*
- AMI Oncotheranostics, LLC

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- Athenex (formerly Kinex Pharmaceuticals) ^
- Acudex, Inc.*
- Canget BioTek Pharma, LLC*
- CH3 Biosystems^
- Chronicle LifeSci America Corp.*
- Efferent Labs*^
- Enhanced Pharmacodynamics*
- Frontier Sciences
- KAPS Biotechnology, LLC*
- Neurovascular Diagnostics, Inc.*^
- Patient Pattern*
- Qoma, LLC*
- Sunstar, Inc.
- Tactiva Therapeutics, LLC*
- Veronomics, Inc.
- Zeptomatrix*^

**indicates Start-Up NY Company*

^indicates UB CAT grant recipient

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	133	12	\$23,945,735	\$4,512,523	\$7,325,194	\$42,642,602	\$868,350	\$79,294,404

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018	Dr. Norma Nowak was invited to be a part of the New York State Life Science Advisory Board commissioned by Gov Cuomo	2018	New York State-Gov Cuomo's Office	https://www.governor.ny.gov/news/governor-cuomo-announces-life-science-advisory-board
2018-2019	<i>RYR1</i> and <i>CACNA1S</i> genetic variants identified with statin-associated muscle symptoms. Paul J Isackson*, Jianxin Wang, Mohammad Zia, Paul Spurgeon, Adrian Levesque, Jonathan Bard, Smitha James, Norma Nowak, Tae Keun Lee & Georgirene D Vladutiu, Pharmacogenomics	Oct. 2018	The Pharmacogenomics Journal	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6563124/
2018-2019	Grant to study "Skin-Derived Neural Crest Stem Cells for Treatment of Neurogenic Disorders"	Aug. 2018	NYS Department of Health	

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2018-2019	Grant to study "DHODH Inhibitors: A Potential New Class of Antimicrobials for Treatment of the Drug Resistant Gram-Negative Bacillus <i>Acinetobacter baumannii</i> "	Aug. 2018	National Institute of Allergy & Infectious Disease	
2018-2019	High-Throughput, Sensitive LC-MS Quantification of Biotherapeutics and Biomarkers Using Antibody-Free, Peptide-Level, Multiple-Mechanism Enrichment via Strategic Regulation of pH and Ionic and Solvent Strengths. Bo and et al; <i>Anal. Chem</i> ; 2019, 91, 5, 3475-3483	2019	Roche Pharmaceutical Research and Early Development, Roche Innovation Center NY	
2018-2019	GenESysV: a fast, intuitive and scalable genome exploration open source tool for variants generated from high-throughput sequencing projects. Zia et al.	2019	BMC Bioinformatics	https://bmcbioinformatics.biomedcentral.com/articles/10.1186/s12859-019-2636-5

Operating Budget (include Federal State, local funds & in-kind)

2018-2019		Matching Funds		
Operating Budget Description	NYSTAR Funding	Company Cost Share	Other Sources	Total Budget
Salaries & Fringe	\$736,330	\$0	\$0	\$736,330
Indirect Costs	\$110,450	\$0	\$0	\$110,450
Equipment	\$10,000	\$0	\$0	\$10,000
Materials & Supplies	\$0	\$0	\$1,672,314	\$1,672,314
Tuition	\$0	\$0	\$0	\$0
Travel	\$18,000	\$0	\$0	\$18,000
Subcontractors	\$70,600	\$0	\$0	\$70,600
Other	\$54,620	\$0	\$995,027	\$1,049,647
Total	\$1,000,000	\$0	\$2,667,341	\$3,667,341

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
NovSeq 6000 Sequencing System	\$200,000	\$0	\$0	\$0	\$200,000

Commercialization Plan

The New York State Center of Excellence in Bioinformatics & Life Sciences (CBLS) is one of the four original CoEs designated in 2001. Since its inception, the CBLS has been vital to the transformation of Buffalo and the greater upstate region as a place for all life science companies to grow.

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The CBLs connects industry partners with academic expertise and advanced equipment to solve commercially relevant problems and drive industrial innovation in New York State. It achieves these ends through active Business Development outreach to potential company partners in New York State as well as internally to UB researchers by providing them with facilities and services to leverage in their interactions with industrial collaborators.

Actual or anticipated new products or processes with commercial application –

Invention Disclosures

Reporting Period	ID Name	Inventor	Co-inventor	Invention Disclosure
7/1/18-12/31/18	Cancer Immune Therapy Using Molecules that Block Immune Suppressive Exosomes	Sathy Balulyer	Richard Bankert, Gautum Shenoy, Terry Connell, Raymond Kelleher, Christopher Greene, Malausri Bhatta	Invention Disclosure
7/1/18-12/31/18	Blue Light ± Photosensitizers to Prevent P. acnes Infection in Orthopaedic Surgery	Kathleen Keely Boyle	John Crane, Thomas Duquin, Swati Bhargava, Sara Diletti	Invention Disclosure
7/1/18-12/31/18	A Protein RNA one stop biosensor for cancer and infectious diseases	Qiaoqiang Gan	Yun Wu	Invention Disclosure
7/1/18-12/31/18	Acid Switch anti-Her2 Antibody Drug Conjugate Biotherapeutic	Dhaval Shah	Andrew Kroetsch, Sheldon Park	Invention Disclosure
7/1/18-12/31/18	Coordinated Holistic Alignment of Manufacturing Processes (CHAMP)	Barry Smith	Jeff Neil Otte, Ron Rudnicki	Invention Disclosure
1/1/19-6/30/19	Defining the human microbiota interaction network and its association with human health by mining biological literature	Dr. Michael Buck	N/A	Invention Disclosure
1/1/19-6/30/19	Early detection and prediction of opioid induced respiratory depression	Jungquist, Carla R.	Mammen, Manoj / Cavuoto, Lora / Chandola, Varun	Invention Disclosure

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1/1/19-6/30/19	Multispectral biophotonics treatments for precision medicine	Arany, Praveen	Rahman, Saeed Ur	Invention Disclosure
1/1/19-6/30/19	Histone Methyltransferase Inhibitors as Therapeutic Agents for Alzheimer's Disease	Yan, Zhen	Feng, Jian	Invention Disclosure
1/1/19-6/30/19	Biocompatible and Degradable Elastomers with Tunable Properties	Mohamed, Mohamed Alaa	Cheng, Chong / Andreadis, Stelios T. / Shahini, Aref	Invention Disclosure

Patents Applied & Received:

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
7/1/18-12/31/18	Phosphoserine Containing Compositions for Immune Tolerance Induction	Sathy Balu-Iyer	Bankert, Richard; Ramakrishnan, Radha; Dingman, Robert; Iyer, Vandana; Schneider, Jennifer; Yau, Fiona; Nguyen, Nhan Hanh	US National 16/091,425	Platform delivery technology based on lipid-based compositions that when complexed with therapeutic proteins, provide for long-acting, less-immunogenic formulations that retain their biological activity. These platforms are applicable to all therapeutic proteins. Their commercial use could represent a paradigmatic shift for the treatment of hemophilia by enabling patients to self-administer the drug.
7/1/18-12/31/18	Peptides and Other Agents for Treating Pain, Inducing Local Anesthesia and Increasing Pain Sensitivity	Arin Bhattacharjee	Kerri Price	PCT Serial No: PCT/US2018/06554	Short peptides derived from the Nav 1.8 sodium channels but differ in their phosphorylation status. Although they are derived from a natural source, the peptides do not exist in nature. The peptides are myristoylated to promote translocation across the neuronal cell membrane. Use of the peptide relieves chronic neuropathic or nociceptive pain. The most likely explanation is the removal of sodium channels from the neuronal membrane by blocking the attachment to the Magi1 scaffold protein. This allows ubiquitination by ligases which mark the channel protein for internalization. Administration of the peptide is as either a local anesthetic or analgesic done by injection, cream or transdermal patch.

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7/1/18-12/31/18	Beam Controlled Spectral-Selective Architecture for a Radiative Cooler	Qiaoqiang Gan	Haomin Song; Zongfu Yu; Lyu Zhou	US Provisional S/N : 62/719,543	Radiative cooling product with no consumption of electricity. It can be used for moisture condensation to address freshwater scarcity. It can also be used to recycle moisture in greenhouse for agriculture.
7/1/18-12/31/18	Biomarkers for Intracranial Aneurysm	Vincent Tutino	Hui Meng	PCT/US2018/42718	This invention detects biomarkers in the blood which signal the presence of an intracranial aneurysm. As such it could be used on a routine basis and would be of special benefit to individuals and families with a predisposition to aneurysms.
7/1/18-12/31/18	Smart Healthcare System	Qiaoqiang Gan	Jian Feng; Zhi Sun; Joseph Jornet; Ed Furlani	US Provisional 62/607,897	This invention is comprised of a flexible bio-photonic sensing implant and an external device capable of activating and obtaining data from the same. A small surface plasmon resonance grating is implanted subcutaneously in a patient. This grating is bio-functionalized that is locations on its surface are chemically optimized to attach specific analytes. The analytes can be biomarkers or any other chemical that is useful to identify or measure.
7/1/18-12/31/18	Broad Protective Protein Antigens for Pneumococcal Disease	Jonathan Lovell	Blaine Pfeifer; Charles H Jones	US National 16/091,032	A highly conserved antigen that when formulated as a vaccine, confers broad protection against pneumococcal disease without adversely impacting colonization by non-disease causing strains.
7/1/18-12/31/18	Compositions and Methods for Immune Tolerance Induction	Sathy Balu-Iyer	N/A	10,064,922 (Received)	Platform delivery technology based on lipid-based compositions that when complexed with therapeutic proteins, provide for long-acting, less-immunogenic formulations that retain their biological activity. These platforms are applicable to all therapeutic proteins. Their commercial use could represent a paradigmatic shift for the treatment of hemophilia by enabling patients to self-administer the drug, much like diabetics do with insulin.

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7/1/18-12/31/18	Compositions and Method for Light Triggered Release of Materials from Nanovesicles	Jonathan Lovell	Ravindra Pandey; Shui Shao; Kevin Carter	US 10,086,074 (Received)	UB researchers have developed specialized liposomes with robust membranes that are made permeable by exposure to near-infrared light. Liposomes re-seal afterwards. This novel material allows drugs to be released exclusively at target sites. For example, activation could occur through use of laparoscopically guided fiber optic placed in a tumor following administration of the liposomes. This procedure would be minimally invasive and would require only a small keyhole incision.
7/1/18-12/31/18	Surfactant-Stripped Micelle Compositions with High Cargo to Surfactant Ratio	Jonathan Lovell	Mansik Jeon; Chulhong Kim; Yumiao Zhang; Wentao Song; Jumin Jeng	Canada 2,954,064 (Received)	UB researchers have developed a novel nano-formulation called 'Nanonaps' for safe, non-invasive and non-ionizing approaches for dynamic molecular imaging of the gastrointestinal tract in real time. These features would be very valuable for many GI related disease and diagnostic scenarios.
1/1/19-6/30/19	Nanostructures Comprising Cobalt Porphyrin-Phospholipid Conjugates and Polyhistidine-Tags	Lovell, Jonathan	N/A	16/399,581 (Applied)	The present disclosure provides functionalized nanostructures. The nanostructures can be used for delivery of cargo, targeted delivery and/or delivery of presentation molecules. We show that lipid bilayers containing porphyrin-phospholipid, which is chelated with cobalt, but not other metals, can effectively capture his-tagged proteins and peptides. Peptides or synthetic peptide can be bound to liposomes containing an adjuvant (such as the lipid monophosphoryl lipid A) for antibody generation for otherwise non-antigenic peptides.
1/1/19-6/30/19	Methods for Evaluating Immune Based Therapies for Cancer	Balu-Iyer, Sathy	N/A	62/795,984 (Applied)	This application describes a method for establishing a mouse model and evaluating the efficacy of immune-based, including but not limited to patient-derived T-cells and other therapies for cancer treatment.

1/1/19-6/30/19	Anti-HER2 Antibodies and Drug Conjugates	Shah, Dhaval K.		62/856,567 (Applied)	This application describes antibody compositions and fragments that exhibit pH-dependent binding, wherein they possess high affinity at physiologic pH and low affinity at endosomal pH. The application also describes compositions comprising these antibodies (and fragments) attached to toxic payloads (i.e. antibody-drug conjugates).
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Start-up Companies Formed –

No start-ups formed this reporting period.

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

None this reporting period.

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers -

UB CBLS offers a multitude of workforce development opportunities for a variety of ages and education levels. Sandra Small, Ph.D., the Science Education Manager, leads these initiatives. Her duties include, science career education outreach, genomics and bioinformatics education in formal and informal K-16 environments through UB's Genome, Environment and the Microbiome Community of Excellence (GEM), managing the CBLS and CMI Career Experience Programs, and interfacing with new and growing companies to help fulfill their workforce needs.

Student-Oriented Workforce Development

- **Life Sciences Career Experience Program:** During the reporting period, CBLS recruited and supported 21 full-time UB students - undergraduate and graduate - working at 21 local life sciences companies during the Spring 2019 semester. Students were allowed to work a total of 144 hours, typically allocated as 12 hours per week for 12 weeks. The participating companies are life sciences companies, but the positions that they posted were varied, including lab sciences, business, IT, and market research. UB's New York State Center of Excellence in Materials Informatics (CMI) administers an identical program focused on the materials and advanced manufacturing industries. Recruitment for both programs occurs simultaneously during the preceding fall semester.
- **Buffalo Public School STEM Experience:** UB CBLS has a strong relationship with the Buffalo Public Schools (BPS), the City of Buffalo and SUNY to promote Science, Technology, Engineering and Math (STEM) awareness through the "BPS STEM

Experience" Program. The year 2019 was the 5th annual Buffalo Public School STEM Experience. The UB CBLS was heavily involved in the following affiliated events:

- **Genome Day:** Four hundred, eighth grade BPS students and over 50 student, faculty and staff volunteers participated in this annual event. Students visited the UB Jacob's School of Medicine and Biomedical Sciences building to learn about DNA and genetics. They had the opportunity to interact with UB scientists, ask questions and learn what it is like to work in science. Students also participated in an activity to extract and visualize DNA from their cheek cells and take it home in a keepsake necklace. All UB CBLS staff members participated in this event.
- **Science Exploration Day:** Science Exploration Day (SED) is an annual science conference for area high school students. Students spend a day on UB's North Campus and choose to attend science and engineering talks and activities for three (3) concurrent sessions. Dr. Small facilitated UB funding to allow BPS students to attend SED and led one of the sessions offered for students to attend.
- **School Relationships:** UB CBLS has developed relationships with many area schools, including Buffalo Public Schools, BOCES, Sweet Home School District, Hamburg High School, and West Seneca High Schools. UB CBLS continues to grow this list of partnerships with visits to classrooms, hosting students at CBLS and teacher training.
 - **Health Sciences Symposium:** Dr. Small organized the first annual Health Sciences Symposium for high schools and juniors who are part of area Health or Life Sciences Academies. This was a one-day event with concurrent sessions focused on all aspects of health sciences, including surgery, dentistry, research, drug development, and infection control. Over 100 students, from three school districts, participated. This event was hosted in the Jacobs School of Medicine and Biomedical Sciences building in conjunction with the Department of Surgery. Session partners included Roswell Park Comprehensive Cancer Center, Hauptman Woodward Institute, Kaleida Health, and Ivoclar Vivadent. This event was a success and schools expressed interest in holding it annually.
 - **Surgery Skills Competition:** Through the Health Sciences Symposium, Dr. Small formed a relationship with the Department of Surgery in UB's Jacobs School of Medicine and Biomedical Science. She served on the planning committee for the department's surgery skills competition, UB Drone STEM. This was a successful event held in May 2018, participating high school students participated in surgery skills challenges, including suturing, "pea drop," "peg transfer," and "Super Monkey Ball" video game. These are all methods that surgeons use to practice their skills and it was a great introduction for students. Three schools from The Buffalo Public School District, Health Sciences Charter School and Hamburg High School each sent a team of 10 students to compete. Building off of the success of this program, the Jacobs School of Medicine and Biomedical Sciences has

expressed interest in developing a more in-depth program for students throughout the academic year with built-in academic supports.

- **Science Education Partnership Award (SEPA):** UB Faculty member Steve Koury has been awarded the Science Education Partnership Award by the National Institutes of Health to support professional development for teachers and more experiential learning for students in bioinformatics. Dr. Nowak, UB CBLS Director, is Co-investigator on the award. As part of SEPA, Drs. Nowak and Small participate in many related activities and programs, including teacher training, student visits and capstone events. Drs. Nowak and Small are key personnel on a new NIH SEPA grant submission to expand upon the bioinformatics education, which is already being implemented with high schools in Western New York.
- **CBLS Tours:** The CBLS and Center for Computational Research (CCR) host facility tours for middle and high school students, teachers, community leaders, and industry groups. The tours highlight the core facilities and the variety of careers that exist in the building.
- **WNY STEM Hub:** The WNY STEM Hub is a consortium of educators, administrators, counselors, and industry professionals working to increase STEM awareness in WNY. The group was founded in December 2013, and hosts meetings and events at the CBLS. Dr. Small is a member of that group.
- **Partnership with GEM:** UB's "Genome, Environment and Microbiome" Community of Excellence (GEM) was initiated in 2015. One of GEM's missions is to increase education and awareness about genomics, the microbiome and the environment's effect on both. Dr. Small works with both GEM and UB CBLS on genome and microbiome education in the community and in K-12 schools. Dr. Small has worked with local educators to develop new lessons to encourage genome and microbiome education in schools. This partnership broadens the educational reach already being supported by UB CBLS. Dr. Nowak is a co-director of GEM.
 - **"Sophia Learns about Research:"** Dr. Small has formed a relationship with the UB Clinical and Translational Science Institute (CTSI) to increase education about research and clinical trials at the elementary school level. CTSI has written a book to teach children what clinical trial participation is like. Dr. Small has been working with CTSI to convene focus groups with teachers and setting up classroom visits. This is an ongoing project and will be introduced to classrooms during the Spring 2019 semester.
- **Research Laboratory Program in Bioinformatics and Life Sciences:** UB CBLS has supported, from the beginning, the creation of a new high school in the Buffalo Public School District, the Research Laboratory Program in Bioinformatics and Life Sciences (RLP). The creation of which was inspired by Genome Day. Dr. Small is a member of the steering committee for the school.

- **After School Program:** Following successful after school science programs during the 2017 Spring semester and 2017-2018 academic year, CBLS was again selected to provide an after school program for the 2018-2019 academic year. An average of 20 students regularly attended this program. All of the lessons, activities and field trips supported what was being taught in the school's science classes.
- **Summer Youth Employment Program:** Through the Erie County "Summer Youth Employment Program," The Buffalo Urban League and Dr. Small's relationship with RLP students, two students were placed in UB research labs to work in paid positions for the summer. The young women are entering their junior year in September 2019.
- **Buffalo Niagara Medical Campus BNMC SummerSTEM Program**
 - Dr. Small led a committee with representatives from Buffalo Manufacturing Works, The Jacob's Institute and The Buffalo Niagara Medical Campus in planning and implementing the third annual BNMC Summer Workshop, summerSTEM for students entering the Research Laboratory or Math, Science, Technology Preparatory High Schools. The committee was awarded a grant from The Cullen Foundation to fund the 2018 program. Students spent two weeks on the Buffalo Niagara Medical Campus visiting different institutions and participating in hands-on activities to apply their knowledge of biological sciences. They were exposed to a variety of careers and future camps, programs and internships.
 - Dr. Small continued her role leading a committee of representatives from The Buffalo Niagara Medical Campus (BNMC), Buffalo Manufacturing Works (BMW) and The Jacobs Institute to organize the 2019 summerSTEM Program, which will be held from July 22 – 26.
- **BNMC Open House:** The Buffalo Niagara Medical Campus (BNMC) annually hosts an open house for area middle and high school students and parents. This year's event was held on April 13, 2019. Participants visited various buildings on the campus and participated in hands-on learning activities. Visitors to UB CBLS were able to make their own bio-art drawings using yeast and petri dishes. The young bio-artists were able to take their masterpieces home and watch the drawing appear as the yeast develops.

Strategic plan

CBLS is focused on supporting business development efforts that result in driving revenue to the Center and support regional economic development. This includes facilitating growth in (1) commercial revenue from both large and small commercial customers; (2) increasing competitively awarded research and development grants; and (3) increasing facility utilization and new campus developments. The Center will pursue an economic development strategy, including but not limited to:

- Advance the state-of-the-art through interdisciplinary, collaborative, life sciences translational research.
- Drive economic development through innovation and commercialization.

- Increase and enhance collaborative relationships with state and federal industry, and academic partners.
- Increase corporate and public funding for research and commercialization efforts.
- Provide workforce development and business development & commercialization programming and services.

Several strategies are deployed in expanding our existing base of companies. These include:

- **Recruitment of a new and expanded Business Development team** - Dr. Alan Belicha was recruited from Mt. Sinai Innovation Partners as Director of Business Development & Industry Engagement in 2017. The Center has since recruited two new Life Sciences Business Development Associates with deep technical knowledge and partnering experience in September 2018.
- **Internal outreach** – The first priority of the new BD team has been to understand what they will be 'selling' in terms of the technology assets at CBLS and to identify and develop relationships with UB's most active and high-profile researchers, especially those that are most relevant to the technology focus of the Center. In the past year, a campaign of active internal outreach involving one to one meetings and interviews has been undertaken by the new BD team to understand the research and capabilities of UB's life science and life-science related engineering and computer science researchers. Wherever possible, each fact finding mission has been followed by targeted outreach to New York State companies for sponsored research collaborations.
- **External outreach** – Along with targeted active outreach to NYS companies, the BD team has attended relevant conferences, trade shows and partnering events both locally across New York State and nationally with a view to engaging New York State bioscience companies. The BD team also work to identify local high potential companies with minimal existing CBLS engagement and expand their interactions with the Center. Other resources are leveraged to initiate and support these interactions, including NYS funding schemes that include the Center for Advanced Technology in Big Data and the Health Sciences, Start Up NY, the Buffalo Institute of Genomics and Data Analytics, faculty collaboration, technology licensing, NSF I-Corps programs, the CBLS Career Experience Program, co-location (tenancy), equipment utilization, and student involved initiatives.

The CBLS team maintains relationships and referral networks with our partner economic development organizations and incubators in Western New York as well as UB through which resources such as talent, faculty expertise and student internships can be offered to companies. This serves to uncover additional partners through referrals and opportunities to partner and deepen past or existing relationship with industry partners.

- **PR and Marketing** – The Business and Entrepreneur Partnerships (BEP) marketing team works to promote the Center externally through generating promotional material for dissemination at events, hosting events at CBLS, designing web collateral, and running email campaigns to promote the Center's resources to New York State companies. They also aim to promote partner companies and the CBLS by providing PR opportunities in the form of

white papers, sharing on social media, and featuring success stories about the company on UB's website to highlight successful partnerships and the company's progress towards their goals.

- **Adjusting University commercialization policies** - Under Framework for Commercialization, there are details about the University's new "business friendly" approach to industry engagement that includes modified IP terms and ease of access to university resources, faculty expertise and student interns. All of these are designed to reduce friction in the partnering process and to enhance the University's reputation as a good industry partner. The UB SWIFT accelerated licensing terms have been commented on as very novel and reasonable by several partner companies.

A critical development that will be leveraged to expand the Center's reach in the pharmaceutical industry, among others, is the development and implementation of UB's new Biorepository Program. This enterprise-level initiative will create a unique bio-medical resource for research institutions and industry throughout New York State and across the country.

UB's Biorepository Program will provide high-quality biomaterials to support science and clinical research through centralized and standardized services for the collection, processing, management, and distribution of biological assets. It will enable critical clinical science research and diagnostic development as well as the advancement of precision medicine through deep annotation and "big data" integration.

A new strategy for expanding CBLS's reach in AI, machine learning and analytics will be to engage faculty in the Computer Science and Engineering department at UB. On the technology licensing side, a closer collaboration with the UB is being discussed and developed to enable BD's outreach activity to focus not just on research collaborations, but also on engaging companies via existing filed technologies and IP.

Governance Structure (including respective roles of partners)

The CBLS Executive Director, Norma Nowak, PhD, was appointed in 2015. She reports to Christina Orsi, UB's Associate Vice President for Economic Development and the head of the newly created Office of Business and Entrepreneur Partnerships (BEP.) Under this new structure, additional personnel have been hired to enhance the team's capabilities to fulfill its objectives. The Director of Business Development, Alan Belicha, PhD, joined UB in July 2017, and two new Business Development Associates for the Life Sciences, David du Plessis, PhD and Benjamin Paluch, PhD, were recruited in September 2018.

NYS Center of Excellence in Materials Informatics
University at Buffalo
Dr. Alan Rae

Technology Focus: Cutting-edge materials science and informatics

Importance to NYS: UB's New York State Center of Excellence in Materials Informatics ("CMI" or "the Center") has importance to New York State because it leverages the University's cutting-edge materials science, big data analytics, and advanced manufacturing expertise and infrastructure to drive critical R&D activities that directly impact private sector growth.

Together with UB's Center for Advanced Technology (UB CAT) and the New York State Center of Excellence in Bioinformatics & Life Sciences (CBLS), the CMI anchors UB's technology-based economic development (T-BED) infrastructure. These centers provide the platform whereby the University engages with New York State to develop and implement priority projects like the Buffalo Billion Investment Development Plan's Buffalo Manufacturing Works (\$40M over five years), SUNY Tax-free Areas to Revitalize and Transform Upstate NY (START-UP NY), and other large-scale, public-private partnerships. The three NYSTAR-supported Centers bring critical and unique assets to the region in terms of both technologies and teams with scientific, business development, economic development, finance, and legal expertise.

UB is a comprehensive, research-intensive university and a member of the prestigious Association of American Universities (AAU), an association of 64 elite research universities in the U.S. and Canada.

The university's goals broadly encompass academic excellence and engagement with the regional, national and international communities it serves. This includes advancing science and technology, and the preparation of the next generation of scientists, engineers and entrepreneurs to drive economic prosperity.

Purpose

The CMI's purpose complements many of UB's and New York State's goals. It raises awareness of local industrial capabilities and needs, and drives collaboration among UB faculty to address these needs. The Center provides funding opportunities to UB faculty who are partnering with the industry to find solutions to materials informatics related challenges and enables student experiential learning prospects within local companies. The CMI contributes to the university's translational research, which enhances UB's visibility and economic impact, locally, statewide and globally. In addition, the CMI collaborates with several UB initiatives in the fields of advanced manufacturing and materials innovation, including the Sustainable Manufacturing & Advanced Robotic Technologies (SMART) Community of Excellence, Research and Education in eNergy, Environment & Water (RENEW) Institute, Computational and Data-Enabled Science & Engineering (CDSE) Program, and the rapidly growing Department of Materials Design & Innovation (MDI).

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	40	5	\$6,442,500	\$198,000	\$3,690,000	\$16,739,500	\$205,000	\$27,275,000

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

Operating Budget

2018-2019

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$621,888	\$0	\$595,661	\$1,217,549
Indirect Costs	\$93,283	\$0	\$0	\$93,283
Equipment	\$26,483	\$0	\$76,333	\$102,816
Materials & Supplies	\$54,986	\$0	\$0	\$54,986
Tuition	\$10,860	\$0	\$0	\$10,860
Travel	\$20,000	\$0	\$0	\$20,000
Subcontractors	\$120,500	\$0	\$0	\$120,500
Other	\$52,500	\$0	\$354,419	\$406,919
Total	\$1,000,500	\$0	\$1,026,413	\$2,026,913

2018-2019 Total Federal:

2018-2019 Total In-kind:

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Vacuumless Thinky centrifugal mixer	\$5,840	\$0	\$0	\$0	\$5,840
Split tube furnace	\$22,052	\$0	\$0	\$0	\$22,052

Commercialization Plan

The CMI leverages UB's cutting-edge materials science and informatics scientific expertise to drive innovation and critical R&D activities that directly impact private sector growth in several target industries including, broadly:

1. Advanced Manufacturing
2. Life Sciences
3. Clean Energy

The Center has established itself as a critical nexus between industry and faculty expertise to solve technical and business-related challenges. The CMI – through its business development efforts – connects companies-to-faculty and faculty-to-companies. UB faculty researchers regularly contact

the Center seeking new industry collaboration opportunities in domains that align with their interests and expertise.

The CMI annually funds faculty/industry collaborative applied research activities through its Collaborative Applied Research Engagement Program with Industry. The objective is to align university research expertise and resources with industry needs and commercial interests. This alignment is a critical criterion in vetting and evaluating funding proposals. To date, 21 applied research projects, totaling approximately \$624,000, have been awarded to faculty with industry collaborations in the following Target Industry Sectors, described as application/material domains:

Clean Energy	Light emitting diodes, photovoltaics, supercapacitors, fuel cells
Healthcare	Drug delivery, tattoo removal, infection control
Semiconductors	New CMOS-compatible devices, electronics for extreme environments
Environmental	Surfactants, water filtration & gas separation membranes, drag reducing marine coatings, ceramic fiber characterization, degradable polymers
Additive manufacturing	Liquid metal jet printing
Industrial controls	Extreme environment flexible sensors

The following table lists examples of the businesses the CMI has been working with over the past several years. The Principal Investigator and period are included along with the award amount and name of the company that supported the collaboration. The project purpose and commercialization outcomes are also described. In addition to these projects funded through annual calls for proposals, the CMI has made need-based and opportunistic expenditures, usually leveraged by other sources, for repair or installation of equipment and co-funding of activities with programs such as the SUNY Networks of Excellence initiative.

Faculty, Period, Award, Company	Commercialization Outcomes
<p>Lewis, Kemper</p> <p>7/1/2018 - 6/30/2019</p> <p>\$40,000</p> <p>Moog, Elma, NY</p>	<p>Title: "From Conventional to Additive Manufacturing: Determining Component Fabrication Feasibility Using Design Informatics and Geometric Reasoning"</p> <p>The applied research developed a framework that investigates fabrication feasibility for Additive Manufacturing (AM) from three perspectives: geometric evaluation; build orientation/support generation; and material-dependent resources necessary (i.e., cost and time). Geometry and material informatics are used to assess options for each part such as "AM fabrication is feasible for the shape as designed, cost and time are feasible, or alternatively "not feasible", respectively.</p> <p>The core developments include: Geometric assessment of the STL file; efficient estimation of the optimal build orientation, comprehensive model to predict the cost and time required to pre-process, build, and postprocess each part; and an algorithm to auto-correct parts that have critical features unable to print using AM. The output</p>

	<p>leads to a reduction in errors and printing failures, and also avoid ineffective use of available resources.</p> <p>The software framework that has been developed is expected to reduce the cost of part evaluation and reduce lead time from days to hours. With the current volume of parts being evaluated, this would have a cost saving of approximately \$70,000 per annum, according to the company partner. Further development opportunities exist, and a commercial product could also result.</p>
<p>Nalam, Prathima Wodo, Olga</p> <p>7/1/2018 - 6/30/2019</p> <p>\$40,000</p> <p>Ecovative Design LLC, Green Island, NY</p>	<p>Title: "Morphology and Permeability of Mycelium for Development of Biodegradable Purification Membranes"</p> <p>The applied research results include the development of a large library of SEM of mycelium foams, microstructural analysis, and identification of volume elements, effective segmentation and estimates of features of the network. Unsupervised learning methods were employed to analyze images. From this, microstructure reconstruction using convolution surfaces enabled the extraction of features such as porosity, fiber radii and the underlying skeleton of the microstructure. This step fed the computational modeling of the network properties for prediction of the properties of the material. This work is ongoing.</p> <p>The next steps include the generation of scaling laws between structure and transport properties to establish filtration characteristics. Also, the adsorption kinetics of the filtrate needs to be determined as a function of the surface chemical functionality of the fiber. Cornell Center for Materials Research was helpful with obtaining three dimensional micrographs of mycelium hyphae (the thread-like fibers).</p> <p>The underlying solid-state fermentation platform that produces the MycoFlex™ advanced material is positioned to serve several markets. These addressable markets include alternative protein (e.g., whole cut meat replacements), personal care (e.g., cosmetics and formula applicators) and textiles (e.g., alternatives to leather). The MycoFlex™ advance material has already returned \$10M in licensing royalties to the business and will continue to grow as new markets and territories are addressed.</p> <p>The company is currently investing heavily in new infrastructure to accelerate both research and commercial scale-up opportunities. Several papers and speaking engagements have also resulted or are in process. Also, new federal funding opportunities have been won by the leveraged PI's expertise.</p>
<p>Ren, Shenqiang</p> <p>7/1/2018 - 6/30/2019</p> <p>\$40,000</p> <p>Tapecon, Buffalo, NY</p>	<p>Title: "The Printable Copper-Based Ink for Metal Conductor towards Energy Efficiency"</p> <p>The applied research developed the printable copper ink chemistry for the scalable production of copper ink slurry for printable electronics where the copper nanostructures are designed and synthesized using the aqueous solvent at ambient conditions. The printable copper ink formula is developed for the compatibility of the direct writing technique where the conducting additives are examined for the electric</p>

	<p>conductivity of copper-based conductor. In addition, the research achieved high electric conductivity of the printable copper conductor at room temperature processing conditions. The printable copper conductor is fabricated at room temperature (without thermal annealing) for the structural and electric performance evaluation where the relationship between the printed conductor thickness, processing conditions and its electric conductivities are established.</p> <p>The current conductor ink in the printable electronics industry is primarily dominant by using the silver ink where a relatively high thermal annealing treatment is required to remove the additives and solvents for high conductivity. This process limits its productivity and worker safety due to the volatile solvent evaporation, thermal annealing and high cost of silver ink. The developed copper conductor ink for printable electronics does not need the thermal annealing step, in addition to its aqueous nature, which can significantly reduce the manufacturing cost and increase the productivity with the environmental benefit.</p> <p>The development of copper ink is currently in progress for the evaluation of ink jet printing at UB, which can make the economic impact in the coming years with the continuous collaboration with Tapecon. UB is developing a sustainable plan with Tapecon to impact the potential business of printable electronics sector. In addition, with this one-year development, the PI is currently engaging with Army Research Laboratory (ARL) to develop the cooperative agreement (\$2M over five-year) for the evaluation of the copper conductor for printable electronics.</p>
<p>Nouh, Mostafa</p> <p>7/1/2018 - 6/30/2019</p> <p>\$32,000</p> <p>Corning, Corning, NY</p>	<p>Title: "Enhanced Thermoacoustic Materials for Power Generation and Cooling Applications"</p> <p>The overall objective of this CMI project was to drastically enhance the performance and energy conversion efficiency of thermoacoustic devices whether in the form of energy generators or refrigeration systems.</p> <p>The applied research accomplished the theoretical analysis and the simulated operation of the acoustic phase controllers, which supports the modeling objectives. The build-up and fabrication of two separate prototype thermoacoustic engines has made good progress, but it is still "in progress". The large-scale device operates, while the miniature small-scale device is more challenging and difficult to operate due to the downscaling of the different components.</p> <p>Once the phase-controller is activated, the researcher has demonstrated a near 30% increase in gross efficiency and 20% increase in net efficiency (i.e. after deducting power consumed by the control effort), in addition to a power density increase as a result of the down-scaling of the entire device.</p> <p>When this technology achieves commercial maturity, thermoacoustic systems are uniquely positioned to make a strong economic as well as environmental impact. These devices outperform thermoelectric energy conversion and have the potential</p>

	<p>to approach entropic limits of efficiency. These contain no moving parts and thus have extremely low (almost non-existent) maintenance requirements.</p> <p>Owing in great part to the work and results produced as part of this project, the PI was awarded a 4-year NSF grant to pursue the next stage(s) of this effort - Award No. 1904254 "Leveraging Metamaterials and Phase Control in Thermo Acoustic Systems", \$399,590. Future tasks will exploit the inevitable nonlinearities emerging from the small and complex pores and leverage a new class of metamaterial-based stacks to further enhance the output acoustic power and minimize boundary reflections.</p>
<p>Hachmann, Johannes</p> <p>7/1/2018 - 6/30/2019</p> <p>\$40,000</p> <p>Kitware, Clifton Park, NY</p>	<p>Title: "Advancing the Software Foundations that Enable Materials Informatics"</p> <p>The project will develop cutting-edge tools and techniques that enable and advance the field of materials informatics at large. The work will help facilitate the paradigm shift towards data-driven discovery and rational design in the chemical and materials domain and help to shape this emerging field. The PI and the scientific software company Kitware will bring together their complementary capabilities and expertise to establish a long-term partnership that will strengthen its product portfolio and business, increase the impact of the PIs research, provide a well-trained workforce them, and help place UB graduates.</p> <p>Prof. Hachmann and Marcus Hanwell, President, Kitware, visited UC Berkeley, the 3rd collaborator in the Kitware DOE proposal. Marcus was invited to present their progress in developing the materials informatics software engine at the DOE PI meeting. Their progress to-date is being well received and the DOE is interested in expanding their funding in ways like what the DOD and Army commonly have done. Per Johnannes, "they are viewing this as more that a one-time shot".</p>

Actual or anticipated new products or processes with commercial application

The following invention disclosures have been filed since the previous report was submitted.

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
7/1/2018-6/30/2019	Piezoelectric Energy harvesting using a nonlinear buckled beam and method for same	Karami, M. Amin		16/326,557	A piezoelectric-based energy harvester device
7/1/2018-6/30/2019	Silica Aerogels, Methods of Making Same, and Uses Thereof	Ren, Shenqiang		62/791,778	Scalable roll-to-roll (R2R) additive manufacturing of silica-carbon composite aerogel for building insulation materials

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7/1/2018-6/30/2019	Biodegradable Elastomeric Scaffolds with Turnable Mechanical Properties Via Thiol-ene Click Chemistry	Cheng, Chong		62/827,036	Cross-linked elastomers for applications including 2D tissue engineered substrates and 3D scaffolds
7/1/2018-6/30/2019	Hierarchical Pore Gradient Ceramic Foams, Methods of Making	Ren, Shenqiang		62/861,892	Scalable pore-gradient ceramic aerogel monoliths (PGAeros) through the biomimetic approach
7/1/2018-6/30/2019	Iron (III) and Gallium (III) Metal Organic Polyhedra, Methods of Making Same, and Uses Thereof	Cook, Timothy R		62/865,18	Iron- or gallium-based alternatives to gadolinium-based MRI contrast agents
7/1/2018-6/30/2019	Self-assembled Fe(III) MRI contrast agents	Morrow, Janet R.	Cook, Timothy R. / Sokolow, Gregory E.	Disclosure	Medical imaging contrast agent alternatives to Gd ³⁺ lanthanide ions
7/1/2018-6/30/2019	Boron Nanoparticles for Neutron Capture Therapy and Proton Capture Therapy	Swihart, Mark	Prasad, Paras N. / Krishnan, Sunil	Disclosure	Selectively enhanced intracellular boron levels in tumor cells, exceeding the threshold level of atoms per cell
7/1/2018-6/30/2019	Periodic Cellular Structure Based Design for Additive Manufacturing Approach for Light Weighting and Optimizing Strong Functional Parts	Rai, Rahul	Jun, Wang	Disclosure	Methods for reducing material waste while increasing heat dissipation that will result in a reduced cost of production
7/1/2018-6/30/2019	Upconversion nanoparticle-based complexes	Prasad, Paras	Singh, Ajay, Kim, Sehoon, Jeong, Keunsoo, Jeong, Cheol Hyun	Disclosure	Theranostic imaging agent for ultrasound applications

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7/1/2018-6/30/2019	Quantum sensing using entangled photons and phonons	Perebeinos, Vasili	Bird, Jonathan P., Li, Huamin	Disclosure	Quantum sensing with photon and phonon entanglement for applications in LIDAR and RADAR, as well as quantum computing
7/1/2018-6/30/2019	Chalcogenorhodacene Compositions of Matter and Utility as Photosensitizers in Dye-Sensitized Solar Cells	Detty, Michael R.	Gast, Kellie, Clark, Michael D., Nasca, Justin, Watson, David F.	Disclosure	Compositions comprised of rhodamine and fluoroescence components incorporated into solar cells with improved performance
7/1/2018-6/30/2019	A new class of electric power source	Chung, Deborah		Disclosure	A new class of electric power source in the form of an electrically conductive electret
7/1/2018-6/30/2019	Plasmonic anodic alumina chips for ultra-sensitive chemical sensing	Gan, Qiaoqiang	Song, Haomin	Disclosure	A more accurate and more dependable method of detecting analytes at a dramatically reduced cost, for use in such industries as Narcotics, Food Safety, Anti-Counterfeit, Biological Research and other elemental analysis
7/1/2018-6/30/2019	Mechanically Robust and Pore Gradient Aerogel Thermal Insulation Materials	Ren, Shenqiang	Yang, Ruizhe, Hu, Feng	Disclosure	Method for manufacturing silica aerogel at less than 10% of the cost of its current composition
7/1/2018-6/30/2019	Metal alloy/oxide composite catalyst technologies of NH ₃ decomposition for hydrogen generation	Wu, Gang	Mukherjee, Shreya, Tang (non-UB), Zhong	Disclosure	A series of supported catalysts that enable ammonia decomposition at lower temperatures
7/1/2018-6/30/2019	3D Porous Graphitic Nanocarbon for Enhancing Performance and Durability of Pt Catalysts	Wu, Gang	Qiao, Zhi, Spendlow, Jacob S	Disclosure	Highly stable porous graphitic carbon materials that enable uniform Pt nanoparticle dispersion and enhanced corrosion resistance compared to conventional carbons

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
7/1/2018-6/30/2019	N/A			

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project Title	Inventor/PI	Licensing or Industry Partner
7/1/2018-6/30/2019	Thermoacoustic Materials for Power Generation and Cooling Applications	Mostafa Nouh	Corning
7/1/2018-6/30/2019	Modeling Quantitative Structure-Permeation Relationships for the Development of Mycelium-based Biodegradable Filtration Membranes	Prathima Nalam	Ecovative Design
7/1/2018-6/30/2019	The Printable Copper-Based Ink for Metal Conductor towards Energy Efficiency	Shenqiang Ren	Tapecon
7/1/2018-6/30/2019	Advancing the Software Foundations that Enable Materials Informatics	Johannes Hachmann	Kitware
7/1/2018-6/30/2019	From Conventional to Additive Manufacturing: Determining Component Fabrication Feasibility Using Design Informatics and Geometric Reasoning	Kemper Lewis	Moog

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

Workforce Development: UB CMI offers a multitude of workforce development opportunities for a variety of ages and education levels. Sandra Small, Ph.D., the Science Education Manager, leads these initiatives. Her duties include science career education outreach, genomics and bioinformatics education in formal and informal, K-16 environments through UB's Genome, Environment and the Microbiome Community of Excellence (GEM), managing the CBLS and CMI Career Experience Programs, and interfacing with new and growing companies to help fulfill their workforce needs.

Student-Oriented Workforce Development

- Advanced Manufacturing Career Experience Program:** During the reporting period, CMI recruited 19 full-time UB students - undergraduate and graduate – to work at 18 local life sciences companies during the Spring 2019 semester. Students were compensated for up to a total of 144 hours, typically allocated as 12 hours per week for 12 weeks. The positions were in a variety of fields, including engineering, business, marketing, and IT. Fifty percent (50%) of the companies which responded to the program survey indicated they retained the student, either on company payroll, part- or full-time position. UB's New York State Center of Excellence in Bioinformatics and Life Sciences (CBLS) administers an

identical program focused on the life sciences industry. Recruitment for both programs occurs simultaneously.

- **School Relationships:** UB CMI maintains relationships with many area schools, including Buffalo Public Schools, BOCES, Sweet Home School District, Hamburg High School, and West Seneca High Schools. UB CMI continues to grow this list of partnerships with visits to classrooms, hosting students and teacher training.
- **Buffalo Niagara Medical Campus BNMC SummerSTEM Program:** Dr. Small led a committee with representatives from Buffalo Manufacturing Works, The Jacob's Institute and The Buffalo Niagara Medical Campus in planning and implementing the third annual BNMC Summer Workshop, summerSTEM, for students entering the Research Laboratory or Math, Science, Technology Preparatory High Schools. The committee was awarded a grant from The Cullen Foundation to fund the 2018 program. Students spent two weeks on the Buffalo Niagara Medical Campus visiting different institutions and participating in hands-on activities to apply their knowledge of biological sciences. They were exposed to a variety of careers and future camps, programs and internships.
- Dr. Small continued her role leading a committee of representatives from The Buffalo Niagara Medical Campus (BNMC), Buffalo Manufacturing Works (BMW) and The Jacobs Institute to organize the 2019 summerSTEM Program, which will be held from July 22 – 26.
- **Science Exploration Day:** Science Exploration Day (SED) is an annual science and engineering conference for area high school students. Students spend a day, in March, on UB's North Campus and choose to attend science and engineering talks and activities during concurrent sessions. Dr. Small joined the planning committee for this event, facilitated the attendance of 300 students from Buffalo Public Schools and led a session activity.
- **Research Laboratory Program in Bioinformatics and Life Sciences:** UB CMI and CBLS have supported, from the beginning, the creation of a new high school in the Buffalo Public School District, the Research Laboratory Program in Bioinformatics and Life Sciences (RLP). The creation of which was inspired by Genome Day. Dr. Small is a member of the steering committee for the school.
- **After School Program:** Following successful after school science programs during the 2017 spring semester and 2017-2018 academic year, CBLS was again selected to provide an after-school program for the 7/1/2018-6/30/2019 academic year. An average of 20 students regularly attended this program. All of the lessons, activities and field trips supported what was being taught in the school's science classes.
- **Summer Youth Employment Program:** Through the Erie County "Summer Youth Employment Program," The Buffalo Urban League and Dr. Small's relationship with RLP students, two students were placed in UB research labs to work in paid positions for the summer. The young women are entering their junior year in September 2019.

Strategic plan

The CMI's broad focus and mission lies at the cross-functional intersection between advanced materials research and the leading edge of applied computational materials engineering. The launch of UB's Department of Materials Design and Innovation (MDI) in 2016, created an enhanced interdisciplinary alignment between the CMI and UB's research expertise. The result of the graduate-level focused MDI department is a closely integrated resource and partner, which elevates the CMI to operate as an incredibly unique technology nexus within New York State that will progress into a powerful asset enabling advancements in new materials development and commercialization outcomes that do not exist elsewhere in the US or globally.

The UB MDI is a new forward-leaning, interdisciplinary department with a new paradigm for materials science research and education. The department's mission is focused on advancing data driven discovery methods, accelerating discovery and design of new materials and processes, and addressing society's toughest challenges. MDI is centered on establishing knowledge discovery in materials science by harnessing the tools of information and data science. It addresses the societal needs for significant acceleration of design and discovery of new materials, emergent properties and processing strategies that impact a broad range of technological applications, including advanced manufacturing and biosciences/technology in a socially responsible manner. MDI aims to use this informatics approach to meaningfully and seamlessly connect bench science with computational science methods.

The critical needs the CMI address with and through the MDI and UB, broadly, include access to advanced analytical instrumentation, wide range of capabilities for modeling, simulation and computational analysis of materials, materials synthesis and process development, and access to materials research faculty that are highly renowned internationally. These areas of expertise support the research, design, development, testing, processing, and prototyping of new materials as well as facilitate the study and characterization of challenges the industries face with current materials.

Participation in the New York nodes of Manufacturing USA such as the Digital Manufacturing & Design Innovation Institute (DMDII) and Clean Energy Smart Manufacturing Innovation Institute (CESMII).

Participation in UB internal events and programs such as the UB Sustainable Manufacturing and Advanced Robotics Technologies (UB SMART), Architectural Ceramic Assemblies Workshop, and Research and Education in eEnergy, Environment & Water (RENEW) Institute, and UB's Department of Materials Design and Innovation (MDI) events such as the Erich Bloch Symposium.

Participation in the UB Innovation Hub. As part of the Buffalo Billion II, ESD is providing a \$32M grant to UB to stand up the Hub. UB is recruiting a Director of Start-up Ventures to run the Hub and lead BEP's entrepreneurship services division. The Hub includes critical infrastructure components such as an early technology commercialization fund for proof of concept and seed investments. These investments are spread over five (5) years to support access to entrepreneur expertise, events, programs and services, and personnel/administration including:

- Programs: integrating start up activity into the classroom through courses and experiential learning. For example, working with UB's law school to stand up a center that would provide course work for law students on business formation and then enable them to work with attorneys on providing the business formation services for startups. Also, Business Management students could be engaged to provide market analysis and develop financials; Communications students could help develop marketing materials and plans for the startups; and Engineering students could help build prototypes. There will also be pitch and student competition events, building on the UB Panasci Competition. Offering tech scouts, business students, embedded with hospital clinicians to understand challenges they commonly face and help develop ideas for solutions that could lead to new startups. The activities are geared toward increasing the engagement of students, faculty and staff in entrepreneur activity.
- Once a new startup is established, the Hub will provide expert support through entrepreneurs in residence and mentors with startup/business experience that can work with the student/faculty to help develop their business plan, raise funding and advance their innovation to the market.
- Also, included is the transition the UB Center of Excellence in Bioinformatics & Life Sciences on the Buffalo Niagara Medical Campus into incubation facilities. The first phase of space will be available in late 2019.

Governance Structure

Mark Swihart, PhD, was appointed CMI Executive Director in 2015. As of July 1, 2018, he has been appointed Chair of UB's Department of Chemical & Biological Engineering. Alan Rae, PhD, has joined the Center on a contract basis as its technical and strategy lead. A position description is being developed and a search will be conducted for a permanent CMI Executive Director in the coming academic year. During this transition, Christina Orsi will be the PI overseeing administrative aspects of the award.

CMI Staff:

- Dr. Alan Rae, Technical & Strategy Lead, consultant
- Dr. Quanxi Jia, Scientific Director (summer salary)
- Christopher Janson, Business Development Executive (100% effort)
- Dr. Xianliang "Ben" Wang, Applications Engineer (100% effort)
- Kathryn Helfer, Budget & Operations Manager (30% effort)
- Julianna Fortain, Marketing & Special Events Coordinator (25% effort)

CMI Industrial Advisory Board (IAB): The CMI IAB was formed in 2015, to provide recommendations for research directions based on industry trends and needs, assist with strategic pursuit of federal funding opportunities and new center designations, and serve as ambassadors in the Western New York region within the community and the greater industrial base. The panel has met twice per year, usually in the spring and fall, but is moving toward quarterly meetings to maintain closer engagement with members.

Center of Excellence in Nanoelectronics and Nanotechnology (CENN)
SUNY Polytechnic Institute
Fatemeh (Shadi) Shahedipour-Sandvik

Technology Focus: Nanoelectronics and nanotechnology mostly focused on transitioning NYS companies to commercialize semiconductor and related technologies such as integrated photonics, power electronics, and neuromorphic computing (AI hardware).

Importance to NYS: As one of New York's most innovative and ambitious high-tech initiatives, the State University of New York Polytechnic Institute (SUNY Poly) and its Colleges of Nanoscale Science and Engineering (CNSE) is home to the New York State Center of Excellence in Nanoelectronics and Nanotechnology ("CENN" or "the Center") and scores of global corporate partners. With more than \$24 billion in combined high tech investments, CENN has been an integral part in establishing the most advanced nanotechnology research, development and deployment complex in the world.

During this reporting period, SUNY Poly in partnership with ESD and SUNY created NY CREATES (New York Center for Research, Economic Advancement, Technology, Engineering and Science) as a new 501(c)(3) non-profit to lead SUNY Poly's economic development portfolio. Under this new structure, the CENN is working with SUNY, ESD and other universities to collaborate with NY CREATES in continuance of its mission and objectives as defined in the Center of Excellence Program statute. Also, during this reporting period NY CREATES with the support of CENN made two significant announcements totaling more than \$3 billion in total investment. These projects are with industrial partners Applied Materials and IBM.

Purpose

CENN's dual mission to enable a robust innovation pipeline by supporting applied research while operating manufacturing scale-up facilities to enable the commercial deployment of this innovation is key to catalyzing a nanotechnology eco-system that has resulted in significant job creation and private sector investment. The manufacturing scale-up facilities that are supported by the CENN at SUNY Poly's CNSE include the only fully-integrated, 300mm computer chip pilot prototyping and demonstration lines within 135,000 square feet of Class 1 capable cleanrooms. This fully-integrated research, development, prototyping, and educational facility provides NYS companies of all sizes strategic support through outreach, technology acceleration, business incubation, pilot prototyping, and test-based integration support.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	1	8	\$0	\$113,182,653	\$775,000	\$0	\$0	\$113,957,653

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

Operating Budget 2018-2019

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$550,200	\$0	\$0	\$550,200
Indirect Costs	\$82,530	\$0	\$0	\$82,530
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$15,000	\$0	\$0	\$15,000
Subcontractors	\$200,000	\$0	\$0	\$200,000
Other	\$152,270	\$0	\$654,826	\$807,096
Total	\$1,000,000	\$0	\$654,826	\$1,654,826

***Although budgeted for \$1M, requests for reimbursements for the period totaled \$606,432.

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Good Chem Resistance High-Speed Spin Processor w/ Options	\$10,340	\$0	\$0	\$0	\$10,340
3 Biochemistry Analyzer, Two Biosensor Modules, One ISE Module	\$25,463	\$0	\$0	\$0	\$25,463

Commercialization Plan

CENN's dual mission is to enable a robust innovation pipeline by supporting applied research while operating industry-compliant manufacturing scale-up facilities to enable the commercial deployment of this innovation is key to catalyzing a nanotechnology eco-system that has resulted in significant job creation and private sector investment. Combined with SUNY Poly's CATN², it focuses on the formation of technology platforms, alignment initiatives and business programs that enable the "Development-phase", and industry partners are supported through each phase of the research, development and deployment (RD&D) commercialization continuum. Specifically, this approach supports a highly integrated continuum of support for technology commercialization projects, entrepreneurial support initiatives, workforce education programs, and regional development strategies all operated under the SUNY Poly umbrella.

The CENN has been central to establishing a statewide next-generation, nanotechnology-enabled open innovation business model that has successfully attracted leading small, medium and large-sized companies from around the world. Today, the CENN oversees state-of-the-art facilities that support a broad array of technology development programs in partnership with over 300 small and large industry leaders resulting in the more than 3,275 scientists, researchers, engineers, students, and faculty all working on the Albany complex. With the CENN's unique co-location model, global industry leaders include growing clusters in nanoelectronics (e.g. IBM, Global Foundries, Applied

Materials, Tokyo Electron, ASML, LAM, and Atotech, among many others), design engineering (e.g. EYP, M+W Group, DPS, Danforth, and CHA) and data sciences (e.g. CommerceHub, IEEE/Global Spec, NY Wired for Education, Windstream, NYS-ITS, NYPA, among others), all represent direct economic impact for NYS with significant investment in equipment, facilities and personnel in a dynamic high tech eco-system.

The CENN is responsible for the management and operation of world-class tools and infrastructure at SUNY Poly CNSE's \$15 billion, mega-complex consisting of over 1,600,000ft² of office, laboratories and classrooms with 135,000ft² of cleanrooms housing the world's most advanced 300mm Si wafer, 150mm SiC wafer pilot-prototype, and manufacturing scale-up and high volume manufacturing (HVM) fabrication lines. More specifically, the CENN has focused its activities and expertise on utilizing advanced nano-processing to enable the commercialization of innovative nanotechnologies, including CMOS devices, Silicon Carbide (SiC) wafer fabrication and silicon-based processes for emerging applications in energy storage, photovoltaics, biohealth, and many others.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
2018-19	Heterogeneous Structure on an Integrated Photonics Platform	Douglas Coolbaugh,	Douglas LaTulipe, Paul Morton, Nicholas Usechak	62/652,810	

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
N/A				

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
N/A			

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

CENN NanoEducation efforts have focused on the construction and operation of facilities that support the growth of a workforce pipeline, including: 1) **Engagement**; 2) **Enrichment**; and 3) **Education**. The CENN NanoEducation efforts have allowed SUNY Poly to develop robust programs and activities that address the needs of the regional workforce by creating a pipeline of interested

and excited students with the appropriate aptitude to succeed in the high-tech workforce. The following are examples of these programs that have had successes during this reporting period.

Engagement

Back to School Expo

On September 15, 2018, the SUNY Poly CENN joined sponsors that included Albany Med, National Grid, PriceChopper, Linium, and SI Group at the 2018 Back to School Expo at the Empire State Plaza Convention Center. This year the expo had the largest attendance at the annual event at nearly 4,000 attendees. The SUNY Poly CENN sponsored an exhibit table where K-12 students could see STEM experiments at work with hands on activities. Events like these are critical to establishing the pipeline of students in the STEM fields.

NanoCareer Days

During this reporting period, CENN helped support SUNY Poly to host over a dozen high schools and middle schools from across the state. This very successful program provided over a thousand students with a glimpse of occupations that they hadn't even imagined. Part of the experience is hands on with some guided experiments. Additionally, it shows these students that not every career within a high-tech field or facility like SUNY Poly requires advanced degrees and that there are several certificate and associate degree programs that would allow the students to succeed in this type of environment.

Teacher Tours

To increase the awareness of educational resources and opportunities, CENN has helped to support an effort aimed at educators. Most of these Engagement and Enrichment programs described here focus on the involvement of the students, but this one engages the educators. The program increases the awareness of the opportunities and options available to them for classroom and out of classroom experiences for their students. If the educators are unaware of what is available, the students will surely suffer. This program connects the educators and, thereby, the students with the tremendous capabilities and facilities that are within our region and available to be leveraged for educational attraction.

Enrichment

Children's Museum of Science and Technology (CMOST)

The CENN continues to support the integration of the Children's Museum of Science and Technology (CMOST) into CNSE. Creating CNSE CMOST, provides a novel education and workforce training. CENN continues to support activities under CMOST. These activities include the Summer NanoCamp "Girls in Science and Technology" program with a focus on getting young girls excited about careers in science and technology.

Pi Day 2019

On March 14, 2019, the CENN helped SUNY Poly to celebrate "Pi Day" by hosting Glenclyff Elementary School. The 65, 4th graders from Glenclyff Elementary were able to learn from Tech Valley High School Students who demonstrated a microscope project they have been tasked with

while SUNY Poly volunteers taught the concepts of Pi through activities that included making “circle airplanes” and “Pi skyscrapers” as well as teaching them how to measure circles and create “Pi poems”. They also received slices of pizza “pies”, a tour of SUNY Poly’s world-class facilities and information about other academic opportunities. The mathematical constant Pi, commonly approximated as 3.14159, is the ratio of a circle’s circumference to its diameter and is often represented by the Greek symbol π . Pi Day is celebrated on March 14 because the first three digits of Pi result in the date 3/14.

Hudson Valley first LEGO League tournament

With the support of the CENN, SUNY Poly’s CNSE hosted one of the qualifying tournaments for the Hudson Valley First Lego League (Grades 4-9). Over 350 people were in attendance for 20 teams competing in this year’s theme of Into Orbit and Mission Moon. Teams use Lego components and coding platforms to run their constructions and robots through pre-planned objectives. The teams also must complete presentations that focus on an explanation of the problem solved, technical details and teamwork.

WSWHE BOCES Southern ADK PTECH

The Washington Saratoga Warren Hamilton Essex Board of Cooperative Educational Services Southern Adirondack Pathways in Technology Early College High School (WSWHE BOCES Southern ADK P-TECH) is an early college academy focusing on Electrical Technology and Advanced Manufacturing. The students came to SUNY Poly for an in depth tour and hands on demonstration. The instructors often work with CENN on programs such as Arduino and Raspberry Pi to incorporate into course curriculums.

Education: K-12, Technical Skills, & Certificate Training

K-12 Education

National Nano Days 2018

NanoDays is an annual, nationwide festival of educational programs about nanoscale science and engineering and their impact on society. NanoDays events are organized by participants in the Nanoscale Informal Science Education Network and take place at science museums, research centers and universities across the country from Puerto Rico to Hawaii. NanoDays engages people of all ages in learning about this emerging field of research, which holds the promise of developing revolutionary materials and technologies. During part of the local public school spring break, April 4 – 6, 2018, the SUNY Poly CENN supported several events that helped to bring nanotechnology education to a range of K-12 educational facilities across the state, including: Riverdale Neighborhood House (Bronx); Albany Police Athletic League; Spring Vacation Camp; and SUNY Poly’s CMOST.

Tech Valley High School

CENN continues to support the Tech Valley High School (TVHS) that is co-located on the SUNY Poly Albany Nanotech Complex in an effort to expand and strengthen the educational pipeline in nanotechnology related fields. This one-of-a-kind educational enterprise provides high school students with a prestigious opportunity to gain access to the world of nanotechnology that few,

even at the collegiate level, are provided while providing the workforce development required to continue the growing nanotechnology industry in New York. During this reporting period, SUNY Poly helped facilitate a technology themed innovation summer camp on 7/18/18 and a biomedical themed innovation summer camp on 7/25/18 for Tech Valley High School.

Albany High School NanoHigh

CENN continues to support nanoscale programs in a variety of ways but most notably through the established NanoHigh program in partnership with Albany High School (AHS) in its Engineering and Nanotechnology Exploration Program. The goal of the program is to immerse AHS seniors in a professional atmosphere to provide a unique educational experience and provide the students with an in-depth introduction to potential career areas. In partnership with SUNY Poly, AHS seniors are introduced to potential career paths in Nanoscience, Nanoengineering and Nanobioscience through daily, on-site instruction and research activity.

The 15-Love Program's Summer Sessions

The 15-LOVE Program has successfully completed over two decades of programming in the Capital Region. What was merely a dream (of reaching out in positive ways to inner-city youth) in June 1990, has indeed become a reality. The late Arthur Ashe was instrumental in helping found the 15-LOVE Program. Representatives from the SUNY Poly CENN shared exciting science, technology, engineering, and mathematics-focused (STEM) concepts as part of a weekly summer program at Albany-based 15-LOVE. Children from local public and charter schools took part in hands-on, nano-centered activities each week in which they made a nano and nature-inspired butterfly craft during the initial session.

15 Love Healthy Futures Club

Continuing SUNY Poly's annual Spring and Summer STEAM programming with 15 Love, the CENN supported monthly STEM concepts as taught through art. Some of these programs included a focus on Binary Code and Data Storage, where the children made floating magnet byte messages and designed their own agamographs (kinetic images), and the other was on wind energy, where the students made pinwheels and wind socks.

Certificate & Project Learning Programs

SUNY Poly Summer Internship Program

The CENN continued efforts to support the SUNY Poly Summer Internship Program reinforcing the educational initiatives that are preparing New York's workforce for a growing number of high-tech career opportunities. The Summer 2018 internship program, which ran from July – August hosted a class of 35 of the best and brightest college students from across the state. This program emphasizes the important efforts the CENN makes to catalyze high-tech growth and connect businesses with a world-class workforce. SUNY Poly is proud to see heightened interest in this prestigious internship experience by undergraduates from across New York. The students spent the summer immersed in unparalleled nanotechnology-based education and research.

Additional SUNY Poly Hosted Industry-Oriented Education and Training Events

Throughout the reporting year CENN has supported SUNY Poly to host scores of other Industry-Oriented Educational events that are not already listed here. These events have hosted more than 11,000 people during this reporting year and include, but are not limited to, the following: Several Nano Career Days for various local school districts; Mohonasen High School CAT Program; IBM Take Your Children to Work Day; Liberty Partnership Program Empire Summit: Young Scholars; American Chemical Society Event; TEL Take your Child To Work Day; Cohoes High School Future Pathways; PV Workshop; IBM Z-Systems Workshop; Park Systems Symposium; IC Fab Workshop; SESA Mini Conference; Tech Valley Summer Camp (New Visions, BOCES); SEMI High Tech University: Teacher Training; IEEE Nanotechnology Symposium; UAlbany African Student Association; CNSE Take Your Child To Work Day; Capstone Presentations; and SEMI High Tech University.

Governance Structure

The CENN has created over the past several years various Industrial Advisory Boards (IABs) with a focus on identifying major gaps in nanofabrication capabilities, including required investment and allocations of resources, timing and opportunities. The Center will now also incorporate the guidance and input from NY-CREATES with a focus on product platforms and market roadmaps to capture input on necessary downstream investment and activities for deployment of the fully integrated system for targeted emerging technology areas (e.g. integrated photonics, SiC power electronics, etc.).

Identify the leadership team of the Center including a brief description of their experience and credentials with respect to commercialization and technology transfer.

- Dr. Michael Liehr, Vice President for Research and Executive Vice President for Technology and Innovation, and Chief Executive Officer of the American Institute for Manufacturing (AIM) Photonics. Dr. Liehr leads the CENN and brings over 25 years of experience in the areas of advanced CMOS integration, 3D packaging, advanced equipment and process control, and electronic materials. Dr. Liehr was also an IBM Distinguished Engineer and served as the General Manager for the SUNY Poly led Global 450mm Consortium.
- Dr. Christopher Borst, Associate Vice President for 300mm Technical Operations, coordinates and manages all aspects of 300mm day-to-day wafer manufacturing and related equipment activities for SUNY Poly and the Center for Semiconductor Research cleanroom operations. Prior to joining SUNY Poly 17 years ago, Dr. Borst served on the Technical Staff for Texas Instruments.
- Dr. Satyavolu Papa Rao, Associate Vice President for Research, heads up the research activities that utilize the 300mm wafer processing facilities. Dr. Rao has worked for International Sematech and IBM.

Give a brief description of the experience and credentials of the personnel responsible for business outreach to your targeted industry or customer base.

- Mr. Michael Fancher, Executive Director of the New York State Center for Advanced Technology in Nanomaterials and Nanoelectronics (CATN2), where he leads the technology development program formation, entrepreneurial development support and clean energy initiatives for the center and SUNY Poly. He has over three decades of experience in industry, government and academia that includes almost 19 years providing executive leadership at SUNY Poly for business development, economic outreach and workforce development activities that has resulted in successful development of a broad array of innovative public and private partnerships with sustainable business models that support technology commercialization, entrepreneurial acceleration, workforce education, and regional cluster formation.
- Mr. Jeffrey Hedrick, Vice President, New York Power Electronics Manufacturing Consortium (NY-PEMC), SUNY Polytechnic Institute and senior executive responsible for leadership, strategic planning, management, financial stewardship, business development, and partner relations. Prior to joining NY-PEMC, Mr. Hedrick served as the Vice President of the Center for Semiconductor Research (CSR) at SUNY Poly and was responsible for overseeing the technical operations of the CSR and business outreach to grow industrial partnerships.
- Mr. Frank Tolic, Associate Vice President for Business, Wafer Processing, is responsible for managing the overall business and satisfaction of companies currently utilizing or looking to utilize the semiconductor processing capabilities at CNSE.

Advanced Energy Research and Technology Center (AERTC)
Stony Brook University
David C. Hamilton

Technology Focus: Improving energy systems, while promoting the adoption of alternative and renewable sources.

Importance to NYS:

The Advanced Energy Research and Technology Center ("AEC" or "the Center") is a partnership of academic and research institutions, energy providers, industry, and government. The mission of the AEC is to increase the efficiency of current energy systems while promoting the adoption of alternative and renewable sources to reduce New York's carbon footprint. The AEC will conduct cutting edge research and development of new technologies to generate, transmit and distribute, store and manage energy, including but not limited to alternative and renewable sources by accelerating deployment of these new technologies and providing education and training to disseminate the skills necessary to implement, maintain and capitalize on their enhanced functionalities. As New York State's designated Center of Excellence in Energy, the AEC facilitates cross collaboration of researchers, industry and energy subject-matter experts throughout the state. This collaboration culminates in the annual Advanced Energy Conference attracting 2000+ attendees with 500+ public and private companies participating, and 40 colleges and universities engaged. The AEC is housed in New York's first LEED Platinum research facility and located at the Stony Brook Research and Development Park, which currently supports 150 energy projects and ten major research and training centers. The fundamental goal of the AEC is to lead research, development, deployment, and work force development efforts to facilitate in reliable, economical and plentiful sources of clean energy for a sustainable economy.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	10	0	\$958,629	\$267,158	\$388,425	\$55,000	\$28,000	\$1,697,212

Designations and Recognitions

NYSTAR's Center of Excellence Report (FY 2018-2019)

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	Allied Microbiota	30-Aug-18	ROI-NJ	https://www.roi-nj.com/2018/08/30/industry/cleanup-crew-allied-microbiota-fights-pollutants-in-n-j-its-hoping-to-move-here-too/
2018-2019	Allied Microbiota	10-Apr-19	Syracuse University	https://news.syr.edu/blog/2019/04/10/innovation-law-center-students-help-allied-microbiota-commercialize-a-clean-tech-breakthrough/
2018-2019	Allied Microbiota - Ignition Grant	30-Sep-19	NYSERDA	https://www.alliedmicrobiota.com/post/design-a-stunning-blog
2018-2019	Allied Microbiota - Innovator of the Year	28-Mar-19	INNOVATE LI	https://www.innovateli.com/2019-innovator-of-the-year-awards/
2018-2019	Brookhaven Technology Group - Innovator of the Year	18-Apr-18	INNOVATE LI	https://www.innovateli.com/rethinking-science-business-clean-energy/
2018-2019	ChemCubed	7-Aug-18	INNOVATE LI	https://www.innovateli.com/3d-printing-soars-startup-provides-missing-ink/
2018-2019	ThermoLift	13-Nov-18	INNOVATE LI	https://www.innovateli.com/cold-start-with-25m-round-set-thermolift-ices-test/

**Operating Budget
2018-2019**

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$2,541,300	\$0	\$290,686	\$2,831,986
Indirect Costs	\$381,195	\$0	\$0	\$381,195
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$492,912	\$492,912
Tuition	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0

NYSTAR's Center of Excellence Report (FY 2018-2019)

Subcontractors	\$0	\$0	\$0	\$0
Other	\$77,505	\$0	\$2,695,230	\$2,772,735
Total	\$3,000,000	\$0	\$3,478,827	\$6,478,828

*** The AERTC was behind on their previous contract and did not execute this contract until 6/20/19. The first three years of the contract (4/1/16 through 3/31/19) were rolled into the initial period of this contract.*

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
N/A	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

Technology Commercialization Process

A Best Practices Based Stage-Gate® Model for Eliciting, Selecting, Developing, and Commercializing Competitive New Technologies.

Objective: To implement an efficient process moving good ideas/discoveries/inventions from conceptualization (lab) to the marketplace.

Actual or anticipated new products or processes with commercial application

Tech	PATENT	ISSUE	APPLICATION	SERIAL	INVENTORS
8039	10,101,219	10/16/2018	Continuation-in-Part (CIP)	14/632,540	Vladimir Samuilov
8720	10001090	6/19/2018	Utility	15/082,469	Benjamin Lawler, Sotirios Mamalis
8486	9,931,611	4/3/2018	PCT	15/034,227	Benjamin Chu, Benjamin Hsiao, Zhe Wang
8628	10,112,150	10/30/2018	PCT	15/325,451	Benjamin Chu, Benjamin Hsiao, Hongyang Ma, Zhe Wang

Start-up Companies Formed

None.

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

AGREEMENT PARTIES	EFFECTIVE DATE	AGREEMENT STATUS	AGREEMENT TYPE	AEC TECHID	DEPT	ROYALTY COLLECTED 4/1/2018 to 3/31/2019
Confidential	7/3/2018	Active	Exclusive License	R-8762, R-8233	(NYSTAR) AEC	\$ None

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

The AEC has a biennial Advanced Energy Conference that attracts almost 2,000 participants and sponsors a "Call for Posters" supported by over 100 undergraduate and graduate students. The next Conference is scheduled for October 2021.

Some of our academic visitor meetings at the Advanced Energy Center:

Adelphi University	KEPCO (Korean Electric Power Corporation)
Alfred University	Kogakuin University
Bayside High School	Nanjing University
Boys & Girls Clubs of America	National Chiao Tung University of Taiwan
BUCT Beijing University of Chemistry	Nayang Technological University
Chaminade High School	PACE University
Chinese Ministry of Education	Queens College
City Univ. London	RPI Energy CAT
City University of New York	Seoul National University Korea
Clarkson University	Syracuse University
Columbia University	UC Berkley
CUSP – NYU Polytechnic	University at Buffalo
Eastern BOCES	University of Michigan
Farmingdale College	Westhampton High School

The Garcia Program hosts a research program for college undergraduate and rising seniors. The Research Experience for Undergraduates (REU) program is a seven-week summer program where undergraduate students work in teams with high school students, high school teachers, graduate students, and post docs on specific research projects of their interest. Many of the REU participants were former high school students who returned for multiple summers. Some students prefer to continue working on the same project with the goal of eventual publication while others opt to sample different projects and gain experience in diverse fields.

Strategic plan

Mission Statement

True partnership of academic institutions, research institutions, energy providers, and industrial corporations. Innovative energy research, education and technology deployment with a focus on efficiency, conservation, and renewable energy and nanotechnology applications for new and novel sources of energy.

Core Functions

- Support NYSTAR mission and requirements as a NYS Center of Excellence
- Foster research collaboration with industry
- Provide business assistance and technology support programs
- Maintain state of the art energy-focused research facility
 - Shared user-facilities
 - Business incubator space
 - Research labs
- Facilitate academic-research-government partnerships
- Conduct recurring Advanced Energy Conference

Governance Structure

- David Hamilton, Director of Operations. AERTC & Executive Director, CEBIP
- Adam Ortiz, Operations Administrator, AERTC
- Christina Poor, Administrative Assistant

Center of Excellence in Wireless and Information Technology
Stony Brook University
Center Director: Dr. Satya Sharma

Technology Focus: Wireless and information technology

Importance to NYS:

The Center of Excellence in Wireless and Information Technology ("CEWIT" or "the Center") mission is to lead, initiate, foster, and manage the transfer of technologies from the research laboratory to the marketplace and facilitate interaction between companies and university faculty and students. CEWIT's competencies include:

- Create high quality jobs within New York State
 - Provide students with opportunities to develop hands-on skills
 - Assist companies in developing core competencies and new businesses
- Maximize the commercial potential of university research
 - Facilitate collaborative research and development programs
 - Generate external support for projects with commercial potential
 - Create and grow startups built on promising technologies

Purpose

CEWIT has two main purposes: conduct research and commercialize it. Stony Brook itself is the most active and successful technology transfer campus in the State University system, generating more than 90% of the aggregate licensing revenues of SUNY's 64 campuses and consistently placing, as a campus, in the top twenty tech transfer institutions nationally, according to the annual survey of the Association of University Technology Managers. Through its "end-to-end" suite of economic development programs, Stony Brook has assisted in the creation or retention of a projected total exceeding 17,000 jobs through more than 2,500 projects with more than 600 New York companies. The Center's 100,000 square foot facility has 40 laboratories, a state-of-the-art data center with multiple high performance clusters, an optical network infrastructure, a lecture and meeting center, and videoconferencing facilities as well as all customary laboratory infrastructure. Since the Center's inception, more than 430 projects have been completed with industry partners and more than 250 projects have been completed for a wide range of federal and state agencies. Over 160 invention disclosures have been filed and more than 110 U.S. patents have been issued, 40 of which have been licensed by the Center's industry partners. During the same period, CEWIT researchers have produced over 1,000 research publications. In addition, CEWIT has successfully organized an annual international conference since 2003 and a hugely popular Hack@CEWIT – the three-day student hackathon – since 2017.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	60	4	\$4,651,972	\$128,000	\$771,345	\$1,083,000	\$131,800	\$6,766,117

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	Aruna Balasubramanian was named N2Women's Rising Star in Computer Networking	2018	N2Women	
2018-2019	Arie Kaufman was inducted into IEEE Visualization Academy	2019	IEEE	
2018-2019	Paul Fodor received 2019 SUNY Chancellor's Award for Excellence in Teaching	2019	SUNY	
2018-2019	Klaus Mueller was named Editor-in-Chief of IEEE Transactions on Visualization & Computer Graphics	2019	IEEE	
2018-2019	Dimitrios Samaras was named SUNY Empire Innovation Professor	2019	SUNY	

Operating Budget 2018-2019

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$0	\$0	\$0	\$0
Indirect Costs	\$0	\$0	\$0	\$0
Equipment	\$0	\$0	\$0	\$0
Materials & Supplies	\$0	\$0	\$0	\$0
Tuition	\$0	\$0	\$0	\$0
Travel	\$0	\$0	\$0	\$0
Subcontractors	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0
Total	\$0	\$0	\$0	\$0

CEWIT does not have an executed contract for this period as of 1/21. They were several years behind on their previous contract which ended 8/31/17 (final report submitted 2/19). Their new contract will run from 9/1/17 – 8/31/22 when executed.

2018-2019 Total Federal: N/A (see note above)

2018-2019 Total In-kind: N/A (see note above)

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
Reality Deck Upgrade	\$0	\$0	\$562,616	\$0	\$562,616

Commercialization Plan

CEWIT has research and development strengths in a wide range of areas that are best aligned with a number of target industry sectors, including but not limited to healthcare and medical

technologies, transportation and logistics, finance and e-commerce, homeland security and national defense, energy and utilities, among others. To assure growth and job creation in all targeted industry segments, there are certain technologies that are essential for improving the productivity of the companies in these segments and creating growth and job opportunities for people in the region and state.

Stony Brook University's new SMART Cluster (Strategic Machine-Learning Acceleration and Ray Tracing Cluster) is a dual use GPU Cluster for both machine-learning and visualization, which is the fastest among New York State academic institutions. It utilizes over 180 NVIDIA RTX6000 GPUs with an aggregate peak performance of 3 Peta FLOPS and 24 tensor Peta FLOPS, which dramatically boosts productivity of deep learning and visualization applications than ever before. It is the first hardware accelerated ray-tracing cluster for real-time cinematic-quality of 1.5 billion pixels. It is an asset to companies for smart manufacturing to financial to high tech in need of powerful AI-enhanced computational capabilities, dramatically accelerated machine learning training and inference, high-end visual computing and analytics, and accelerating of data-intensive and compute-intensive processes.

Machine learning and AI power systems such as self-driving cars, voice-activated assistants, real-time voice translation, and social media feeds. IBM's Watson is now used in medicine. It finds facts relevant to a patient's history and makes recommendations to doctors. Across four states in America it is now legal for driverless cars to take to the road. Intelligent machines are now becoming an everyday reality that would change all of our lives. Scientific advances on a daily basis coming from academic and industrial enterprises continue to lead major breakthroughs.

CEWIT aims to create an ecosystem and culture that will continue to drive innovation through large and small advances derived from joint research programs, cooperative development of platform technologies, reciprocal out-licensing of companies' intellectual property, and through the promotion of leadership skills to foster collaborative relationships. CEWIT understands that not only do we need to help our partners with their immediate needs, but also to bring to their attention those emerging, prospective and potential technologies that can influence their long-term survival and growth.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number
2018-2019	Attenuated Viruses Useful for Vaccines	Jeronimo Cello	John Coleman, Bruce Futcher, Steffen Mueller, Dimitris Papamichail, Steven Skiena, Eckard Wimmer	2,682,089
2018-2019	Attenuated Influenza Viruses and Vaccines	Bruce Futcher	Steffen Mueller, Steven Skiena, Eckard Wimmer, Chen Yang	10,316,294
2018-2019	Four Bar Apparatus and Method for Lifting, Lowering, Exercise and Self-Propelled Transit	Ninad Jagdale	Anurag Purwar	10,130,535

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2018-2019	Apparatus and Method for Feature Extraction and Classification of Fetal Heart Rate	Shishir Dash	Petar Djuric, Gerald Quirk	10,368,755
2018-2019	Attenuated Viruses Useful for Vaccines	Jeronimo Cello	John Coleman, Bruce Futcher, Steffen Mueller, Dimitris Papamichail, Steven Skiena, Eckard Wimmer	5020180000 27139
2018-2019	Attenuated Viruses Useful for Vaccines	Jeronimo Cello	John Coleman, Bruce Futcher, Steffen Mueller, Dimitris Papamichail, Steven Skiena, Eckard Wimmer	287882
2018-2019	System and Method for Processing Brain Images and Extracting Neuronal Structures	Saeed Boorboor	Arie Kaufman	
2018-2019	Two-Factor User Authentication using Vision and Acoustics for Smart Devices	Fan Ye	Bing Zhou	
2018-2019	Machine Learning System and Method for Using Electronic Health Records to Predict Disease State	Janos Hajagos	Richard Moffitt, Sina Rashidian, Joel Haskin Saltz, Mary Saltz, Fusheng Wang	
2018-2019	System and Method for High Precision Infrastructure-free Mobile Device Tracking in Indoor Environments	Fan Ye	Bing Zhou	
2018-2019	System, Method, and Computer-accessible Medium for Subsurface Capillary Flow Imaging by Wavelength-division-multiplexing Swept-source Optical Doppler Tomography	Wei Chen	Congwu Du, Yingtian Pan	
2018-2019	Radio Frequency Energy Harvesting Apparatus and Method for Utilizing the Same	Yasha Karimi	Emre Salman, Milutin Stanacevic, Tutu Wan	
2018-2019	Machine Learning System and Method for Using Electronic Health Records to Predict Disease State	Janos Hajagos	Richard Moffitt, Sina Rashidian, Joel Haskin Saltz, Mary Saltz, Fusheng Wang	
2018-2019	Peptide Inhibitors of P. gingivalis Fimbrial Assembly for the Prevention of Gum Disease and Methods of Treatment Using Same	Sarah Alaei	Dima Kozakov, David Thanassi	
2018-2019	Compositions and Methods for Spinal Disc Repair and Other Surgical and Non-surgical Indications	Arie Kaufman	Qi Sun, Li-Yi Wei	
2018-2019	System and Method Associated with User Authentication Based on an Acoustic-Based Echo-Signature	Fan Ye	Bing Zhou	

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2018-2019	Computational Staining to Generate and Quantify Tumor Infiltrating Lymphocytes using Digitized Diagnostic Tissue Image	Rebecca Batiste	Rajarsi Gupta, Le Hou, Tahsin Kurc, Alexander Lazar, Vu Nguyen, Arvind Rao, Joel Haskin Saltz, Dimitrios Samaras, Ashish Sharma, Ilya Shmulevich, Pankaj Singh, Vesteinn Thorsson, John Van Arnam, Tianhao Zhao	
2018-2019	Peptide Inhibitors of P. Gingivalis Fimbrial Assembly for The Prevention of Gum Disease and Methods of Treatment Using Same	Sarah Alaei	Dima Kozakov, David Thanassi	
2018-2019	System and Method Associated with Determining Physician Attribution Related to In-Patient Care Using Prediction-Based Analysis	Vikas Ganjigunte Ashok	Todd Griffin, Erin Healy, I.V. Ramakrishnan	
2018-2019	Modular Frame Connectors and System Utilizing Same	Jonathan Bellon	Qiaode Ge, Apoorva Godse, Anurag Purwar	
2018-2019	System and Method for Spinal Restoration	Daniel Birk	Nilanjan Chakraborty, Qiaode Ge, I.V. Ramakrishnan, David Rubenstein, T Venkatesh	
2018-2019	System and Method for Electronic Health Records Management Using Blockchain	Alevtina Dubovitskaya	Rohit Shukla, Fusheng Wang, Zhigang Xu, Pratik Sushil Zambani	
2018-2019	System and Method for Method for Ac-powered Encryption	Yasha Karimi	Emre Salman, Milutin Stanacevic, Tutu Wan, Huang Yuanfei	
2018-2019	System, Method, and Accelerator to Process Convolutional Neural Network Layers	Monaj Alwani	Michael Ferdman, Peter Milder	
2018-2019	System and Method for Scalable, Fine-grained Access Control for Internet-of-things in Enterprise Environment	Yuanyuan Yang	Fan Ye, Qian Zhou	
2018-2019	System and Method for Real-Time Multi-Tag Tracking with Single Magnetometer Sensor	Shan Lin		
2018-2019	X-ray Imager Using Storage Phosphor	Adrian Howansky	Anthony Lubinsky, Wei Zhao	
2018-2019	System and Method for Data Centric Medium Access Control Supporting Robust Multicast in Wireless Communication	Mohammed Elbadry	Peter Milder, Yuanyuan Yang, Fan Ye	
2018-2019	Hybrid Active Matrix Flat Panel Detector System and Method	Adrian Howansky	Anthony Lubinsky, James Scheuermann, Wei Zhao	

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2018-2019	System and Method for Accelerating Computation of Convolutional Neural Networks	Michael Ferdman	Tianchu Ji, Peter Milder, Yongming Shen	
2018-2019	System and Method for Automatic Segmentation in Medical Imaging	Konstantin Dmitriev	Arie Kaufman	
2018-2019	Apparatus for Continuous Wastewater Treatment Using Non-Chemical Green Process	Devinder Mahajan	Bruce Futcher, Steffen Mueller, Steven Skiena, Eckard Wimmer, Chen Yang	
2018-2019	Attenuated Influenza Viruses and Vaccines	Bruce Futcher	Steffen Mueller, Steven Skiena, Eckard Wimmer, Chen Yang	
2018-2019	Method for Passive Wireless Channel Estimation in Radio Frequency Network and Apparatus for Same	Akshay Athalye	Samir Das, Petar Djuric, Yasha Karimi, Jihoon Ryoo, Milutin Stanacevic	
2018-2019	System and Method Associated with Expedient Determination of Location of One or More Object(S) Within a Bounded Perimeter of 3d Space Based on Mapping and Navigation to a Precise Poi Destination Using a Smart Laser Pointer Device	Fan Ye	Bing Zhou	
2018-2019	System and Method for Toothbrush Monitoring Using Magneto-Inductive Coil Sensor	Shan Lin		
2018-2019	Compositions and Methods for C1q Targeted Therapy	Berhane Ghebrehiwet	Ellinor Peerschke	
2018-2019	System and Method for Construction of Hierarchies from Multivariate Data	Salman Mahmood	Klaus Mueller	
2018-2019	System and Method Associated with Generating an Interactive Visualization of Structural Causal Models Used in Analytics of Data Associated with Static or Temporal Phenomena	Klaus Mueller	Jun Wang	
2018-2019	System and Method for Unsupervised Histopathology Image Synthesis	Rajarsi Gupta	Le Hou, Tahsin Kurc, Joel Haskin Saltz, Dimitrios Samaras	
2018-2019	Improving Risk Adjusted Mortality Rate Using Automated Determination of Patient Co-morbidities	Mark Henry	I.V. Ramakrishnan	
2018-2019	System and Method for Dynamic Saccadic Redirection	Arie Kaufman	Qi Sun	
2018-2019	System and Method Associated with Progressive Spatial Analysis of Prodigious 3d Data Including Complex Structures	Yanhui Liang	Hoang Vo, Fusheng Wang	

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2018-2019	System and Method for Processing Brain Images and Extracting Neuronal Structures	Saeed Boorboor	Arie Kaufman	
2018-2019	System and Method Associated with Expedient Detection and Reconstruction of Cyber Events in a Compact Scenario Representation Using Provenance Tags and Customizable Policy	Birhanu Eshete	Rigel Gjomemo, Md Nahid Hossain, Sadegh Milajerdi, R. Sekar, Scott Stoller, V.N. Venkatakrishnan, Junao Wang	

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
2018-2019	IPVideo	Stony Brook	IPVideo Corporation harnesses the power of the Internet of Things (IoT) and incorporates artificial intelligence (AI) and machine learning to deliver a range of open platform physical security, sensor, weapons detection, and audio/visual solutions that provide maximum flexibility, performance, ease-of-use and value.	IT
2018-2019	Zeblok	Stony Brook	Zeblok Computational operates a cloud-native Artificial Intelligence Platform-as-a-Service (AI PaaS) with the objective of fundamentally transforming the way enterprises leverage AI within business processes everywhere.	IT

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
2018-2019	Exclusive License	N/A	Xanthic17 LLC
2018-2019	Exclusive License	N/A	SCIVE Labs
2018-2019	Non-Exclusive License	N/A	Tyga-Box Systems, Inc.
2018-2019	Non-Exclusive License	N/A	Corigine, Inc
2018-2019	Option	N/A	Analogic Canada Corporation

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

Hack@CEWIT, CEWIT's annual student hackathon, is specifically designed in conjunction with our core industry partners, sponsors and member entrepreneurs to select scenarios that will have a

direct, real-world application to their product portfolios and providing students the opportunity to work on industry-relevant IoT and microservices solutions. The hackathon's tech talk and deep dive workshop schedule as well as Industry Hacker Guru, or mentorship, program continues to promote STEM education by introducing students to a range of new technologies and possibilities while building positive, encouraging relationships with companies in the STEM fields.

The 2019 Hack@CEWIT program offered students from all across NYS and many other states an immersive hands-on learning experience by delivering instructive content on relevant STEM topics, including hardware builds, software skills and a wide range of hot topics in technology. Program instructors include members of CEWIT's many industry partners, university faculty and other technical experts, who through this three-day program, made voluntary contributions to advancing STEM education and fostering interest in STEM careers.

Through CEWIT's vast partner networks and connections, many K-12 and college-level students obtained internships at participating companies as well as in CEWIT working with affiliated faculty and startup companies in the incubator space. CEWIT also hosts student groups from the community to tour the facility and learn about R&D activities on an ongoing basis. For three years in a row, Prof. Fusheng Wang has offered an NSF-sponsored summer research program, Computer Science and Informatics Research Experience (CSIRE), to 30+ high school students. He also mentored a finalist in the Regeneron Science Talent Search.

Strategic plan

Objectives and Measures

- Objective 1 : Assist companies in creating high quality jobs within New York State
 - 1.1 Jobs created by industry partners
 - 1.2 Jobs retained by industry partners
 - 1.3 Number of joint projects and outreach activities
- Objective 2 : Assist companies in developing core competencies and new businesses
 - 2.1 Increased revenues
 - 2.2 Increased expenditures
 - 2.3 Government funding
- Objective 3 : Expand sponsored research and development programs
 - 3.1 Number of partners attracted
 - 3.2 Number of new technology disclosures
 - 3.3 Number of patent applications and issued patents
- Objective 4 : Maximize the commercial potential of university research
 - 4.1 Number of new partners and licensing agreements
 - 4.2 New startups and commercialization projects developed

- 4.3 Entrepreneurial events organized by or hosted at CEWIT (incubator showcase, commercialization conference, Lean LaunchPad, innovation boot camp, robotics camp, etc.)
- Objective 5 : Provide students with opportunities to develop hands-on skills
 - 5.1 Number of student interns hired
 - 5.2 Research and training opportunities for students
 - 5.3 Hackathons and other events/activities for students

Governance Structure (including respective roles of partners)

CEWIT is part of Stony Brook University's Division of Economic Development. Under the leadership of Dr. Richard Reeder, Vice President for Research, Mr. Peter Donnelly, Associate Vice President for Technology Partnerships, and Dr. Satya Sharma, Executive Director of CEWIT, the Center's staff has been working diligently to pursue interdisciplinary research and technology development. The Center's leadership team includes the Chief Scientist, Business Development Manager, Associate Director of Computing Services, and Director.

**Syracuse Center of Excellence in Environmental and Energy Systems
Syracuse University**

Dr. Eric A. Schiff, interim Executive Director

Technology Focus: Energy and Environmental Systems

Importance to NYS:

Syracuse Center of Excellence in Environmental and Energy Systems ("SyracuseCoE" or "the Center") develops industry-university teams to shape projects, attract external funding, commercialize new products, and establish relationships with global leaders as strategic partners related to project development. It offers technical expertise, outreach opportunities to connect industry with undergraduate and graduate students and economic development programming to bring their capabilities and competencies to bear on industry challenges. Key capabilities and competencies include 1) advanced building systems, 2) clean and renewable energy and 3) water resources.

Purpose

SyracuseCoE engages academic and industry partners to accelerate development and commercialization of innovations for healthier buildings and cleaner, greener communities. SyracuseCoE strategically targets opportunities for innovations that: improve indoor environmental quality and energy efficiency in buildings; provide clean and renewable energy; and improve resilience to storms, grid blackouts, epidemics, and other disasters in urban communities. In addition, SyracuseCoE targets opportunities to engage New York State firms in four key industry sectors: clean technology; digital and electronic devices; advanced manufacturing; and research and engineering services. In the five-county Central New York region alone, firms in these four sectors employ more than 15,000 workers.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	8	0	\$1,458,887	\$6,635	\$1,674,759	\$15,808,656	\$777,379	\$19,726,316

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

**Operating Budget
2018-2019**

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$764,977	\$0	\$354,950	\$1,119,927
Indirect Costs	\$114,747	\$0	\$53,242	\$167,989
Equipment	\$5,000	\$0	\$0	\$5,000
Materials & Supplies	\$14,145	\$0	\$3,403	\$17,548
Tuition	\$0	\$0	\$0	\$0
Travel	\$18,000	\$0	\$5,554	\$23,554
Subcontractors	\$45,000	\$0	\$235,703	\$280,703
Other	\$38,131	\$0	\$545,646	\$583,777
Total	\$1,000,000	\$0	\$1,198,498	\$2,198,498

2018-2019 Total Federal: \$272,048

2018-2019 Total In-kind: \$0

Capital expenditures (include Federal State, local funds & in-kind)

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
N/A	\$0	\$0	\$0	\$0	\$0

Commercialization Plan

SyracuseCoE engages academic and industry partners to accelerate development and commercialization of innovations for healthier buildings and cleaner, greener communities. SyracuseCoE strategically targets opportunities for innovations that: improve indoor environmental quality and energy efficiency in buildings; provide clean and renewable energy; and improve resilience to storms in urban communities. In addition, SyracuseCoE targets opportunities to engage New York State firms in four key industry sectors: clean technology; digital and electronic devices; advanced manufacturing; and research and engineering services.

Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
7/1/2018 – 6/30/2019	Lens Structure for High Intensity LED Fixture	Joseph Casper	Christopher Nolan, Joseph Witkowski, Jeffery R Shuster, Brian M Wilson	US1018248 5	Related to the development of optics to control the beam and projection of light in a high output LED light fixture.
7/1/2018 – 6/30/2019	Lighting Device Assembly & Method	Adam Milam		US2017003 0566A1	Arayed LED structure, cooling system, and mounting for horticultural applications. Current total market size \$2.4B.
7/1/2018 – 6/30/2019	Continuous Flow Fluid	John H. Merrill	Eric Becks, Alex Waldrop	Not provided	Low cost continuous flow monitor to detect waterborne

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	Contaminant Sensing System and Method				contaminants. Commercial applications spanning environmental, industrial, municipal, and drinking water markets.
7/1/2018 – 6/30/2019	Improved Piezoelectric Sensors & Quartz Crystal Monitors	James T. Spencer	Fred Schlereth	US10295504	Covers many improvements in QCMs using functionalized recognition surfaces.
7/1/2018 – 6/30/2019	Electricity and syngas co-generation system using porous solid oxide fuel cells	Jeongmin Ahn	Ryan Milcarek, Pingying Zeng, Kang Wang	US10283794B2	A porous solid oxide fuel cell (PSOFC) system for electricity and syngas co-generation. The system has a porous layer, a porous electrolyte layer with catalyst, a porous anode layer, and a porous catalyst layer. A fuel air/O ₂ mixture is introduced from through the porous cathode layer so that it next passes through the porous electrolyte layer with catalyst, then the porous anode layer and finally the porous catalyst layer.

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
2018 –2019	Threat Sensor Systems	Fayetteville	Biochemical sensors	Sensor
2018 –2019	Cocoon Construct, Co.	Syracuse	Retrofit panels	High performance buildings
2018 –2019	Acumen Detection, Inc.	Syracuse	Environmental pathogen testing	Agriculture

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
2018 –2019	Beneficial Use of paper mill waste to produce biopolymers	Avatar Sustainable Technologies	SUNY ESF

2018 –2019	Development of Novel Quartz Crystal Microbalance Sensors for Environmental Signature Detection	James Spencer	MolecuSense Inc.
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Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

SyracuseCoE faculty, staff and students participated as guest speakers and facilitators in area high school science classes as well as hosted classroom tours of specific labs and meetings with faculty, students and others. SyracuseCoE hosted faculty engagements with community-based STEM organizations such as the Museum of Science and Technology (MOST) in Syracuse, summer science camps and more. SyracuseCoE offered frequent tours of our LEED Platinum facility to many K-12 schools and community college classes from throughout Central New York.

Strategic plan

SyracuseCoE is headquartered in an iconic 55,000-square-foot facility that was constructed on a redeveloped urban brownfield at the intersection of two interstate highways adjacent to downtown Syracuse. SyracuseCoE's headquarters facility has earned international recognition for its innovative design and its unique laboratories such as the Willis H. Carrier Total Indoor Environmental Quality (TIEQ) Laboratory, which has been used to conduct groundbreaking research on the impact of indoor air quality on the cognitive function of knowledge workers. The entire headquarter building and the three-acre site are designed to serve as a laboratory and a testbed for research, development and demonstration projects relating to environmental and energy systems in urban environments. In addition, SyracuseCoE engages dozens of faculty members at its partner institutions—Syracuse University, SUNY College of Environmental Science and Forestry, SUNY Upstate Medical University, and SUNY Oswego—to access additional resources, including laboratories and personnel for collaborative projects, deepening research and development activities in environmental and energy systems in the region and state as well as strengthening the capabilities available to companies engaging in product development and growth in these areas.

SyracuseCoE develops industry-university teams to shape projects, attract external funding, commercialize new products, and establish relationships with global leaders as strategic partners related to project development. It offers technical expertise, outreach opportunities to connect industry with undergraduate and graduate students, and economic development programming to bring their capabilities and competencies to bear on industry challenges. Key capabilities and competencies include advanced building energy and environmental systems, clean and renewable energy, and water resources.

SyracuseCoE tracks its contributions to jobs (created and retained), partner products exported out of the region owing to a SyracuseCoE program result, patent filings from SyracuseCoE-funded R&D, academic expenditures of SyracuseCoE-engaged sponsored projects, and investments secured by SyracuseCoE partnered companies.

Governance Structure (including respective roles of partners)

SyracuseCoE is structured as a public-private partnership that is led by Syracuse University. SyracuseCoE was established in 2002 under New York State's Center of Excellence program to combine activities of the New York Indoor Environmental Quality (NYIEQ) Center, Inc. (a non-profit organization established in 2000) and the Environmental Quality Systems Strategically Targeted Academic Research Center (EQS STAR) Center (a multi-institutional research center competitively awarded to Syracuse University and 11 partners in 2001). Governance of SyracuseCoE activities is led by Syracuse University with advice from CenterState Corporation for Economic Opportunity (CenterState CEO) and industry and academic partners, including SUNY College of Environmental Science and Forestry (ESF), SUNY Upstate Medical University, and SUNY Oswego. Members of SyracuseCoE's Industry Partner Council provide guidance on activities that are supported using funding provided by partner firms and institutions.

Center of Excellence in Data Science
University of Rochester
Walt Johnson, PhD

Technology Focus: Data Science

Importance to NYS:

The Center of Excellence in Data Science is part of a unified strategy to establish the region and the state as a hub for new talent and a leader in analyzing and commercializing the limitless uses of data, improve quality of life and fuel economic growth.

Purpose

The Rochester Center of Excellence in Data Science ("CoE" or "the Center") leverages and further supports the data science expertise at the University of Rochester's Goergen Institute for Data Science (GIDS) with faculty across disciplines of computer science, medicine, brain and cognitive sciences, biomedical engineering, optics, electrical and computer engineering, chemistry, business, biology and other fields.

The CoE is focused on developing and expanding industry partnerships by applying data science in three primary domains:

1. Health Analytics
2. Artificial Intelligence & Cognitive Science
3. Cyber-physical Systems

Additionally, the CoE is committed to the development of new data science methods, tools and infrastructure to drive discovery across these domains and many others, building upon its core strengths surrounding imaging and optics.

The CoE is capitalizing on University infrastructure and expertise in data science and high performance computing while leveraging collaborations with other academic partners, industry, and government agencies. Thanks to support from New York State and IBM, the University is already among the most powerful university-based supercomputing sites in North America. Major investments have developed an outstanding high-performance computing infrastructure to support data science research and analytics. These resources include:

- Center for Integrated Research Computing (CIRC): Provides support services to use computational and data analytics technology in research activities.
- Health Sciences Center for Computational Innovation (HSCCI): Hosts an IBM Blue Gene/Q supercomputer and a new Linux cluster, BlueHive 2, making HSCCI one of the five most powerful university-based supercomputing sites in the nation.
- VISTA Collaboratory: Offers a 1,000-square-foot visualization lab equipped with an interactive, tiled-display wall that can render massive data sets in real time and providing researchers and data scientists the ability to visualize and analyze complex data instantaneously and collaboratively.

Impacts

Reporting Period	New Jobs	Retained Jobs	Increased Revenues	Cost Savings	Govt Funds	Non-Govt Funds	Capital Improv's	Total Impacts
2018-2019	13	1	\$325,855	\$1,745,000	\$908,448	\$11,950,000	\$7,500	\$14,936,803

Designations and Recognitions

Year	Awards / Recognition	Date Received	Recognizing Organization	Link
2018-2019	N/A			

Operating Budget

2018-2019

Operating Budget Description	NYSTAR Funding	Matching Funds		Total Budget
		Company Cost Share	Other Sources	
Salaries & Fringe	\$550,045	\$0	\$549,747	\$1,099,792
Indirect Costs	\$82,507	\$0	\$82,462	\$164,969
Equipment	\$75,000	\$0	\$0	\$75,000
Materials & Supplies	\$0	\$0	\$548	\$548
Tuition	\$0	\$0	\$0	\$0
Travel	\$15,000	\$0	\$7,669	\$22,669
Subcontractors	\$0	\$0	\$0	\$0
Other	\$277,448	\$0	\$11,508	\$288,956
Total	\$1,000,000	\$0	\$651,934	\$1,651,934

***Although budgeted \$1M, The CoE expended \$519,311.*

2018-2019 Total Federal: \$0

2018-2019 Total In-kind: \$0

Capital expenditures

Capital Equipment Purchases	NYSTAR Funding	Federal	Other Sources	In-kind	Total
3 Mellanox IB based EDR Switch port and wires	\$42,150	\$0	\$0	\$0	\$42,150
Dell Power edge R640 Xeon Gold	\$11,619	\$0	\$0	\$0	\$11,619

Commercialization Plan

The Rochester Center of Excellence in Data Science (CoE) leverages and further supports the data science expertise at the University of Rochester's Goergen Institute for Data Science (GIDS) with faculty across disciplines of computer science, medicine, brain and cognitive sciences, biomedical engineering, optics, electrical and computer engineering, chemistry, business, biology and other fields.

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Actual or anticipated new products or processes with commercial application

Reporting Period	Patent Name	Inventor	Co-inventor	Patent Number	Description
N/A					

Start-up Companies Formed

Reporting Period	Company Name	City	Product/Service	Sector
N/A				

Description of each research sponsorship agreement, intellectual property ownership agreement, intellectual property license agreement or any other agreements entered into between the CoE and research partner

Reporting Period	Project	Inventor	Licensing Partner
N/A			

Description of any relationships with secondary schools and community colleges designed to foster student interest in scientific and technical careers

None.

Strategic plan

Strategic business outreach priorities and plans are developed by the CoE leadership and informed by internal and external committees noted below.

Adam Tulgan, Director of Business Development and Engagement, has primary responsibility for implementing business development activities. Adam has more than 15 years of industry experience ranging from a variety of field sales positions at Pfizer, Oracle, Covidien/AutoSuture, and Stryker Neurovascular. His past industry experiences make him uniquely qualified to help build industry-academic partnerships. In his role, he prospects, cultivates and facilitates industry collaborations, aligning the CoE and University's data science priorities in research, technology commercialization, student training and career placement, and access to high performance computing resources.

Additionally, Mike Kennerknecht serves as the Economic Development Coordinator for the CoE where part of his role is focused communications, economic development projects and partnerships with industry and government. Prior to joining the University of Rochester, Mike was the Public Relations Supervisor at Tipping Point Communications in Rochester and he also served as the Chief of Staff to New York State Assemblywoman Donna Lupardo in Binghamton.

Governance Structure

The CoE is managed by a Director, with a Scientific Director who also is the Director of the Goergen Institute for Data Science (GIDS). GIDS is the academic home for data science programs at the University of Rochester and the CoE is housed in GIDS. The CoE Director reports to the Senior Vice President for Research (SVPR) at the University of Rochester. An internal Administrative Committee comprised of the SVPR, Dean of Arts and Sciences, Dean of the Hajim School of Engineering, and Vice Dean of the School of Medicine and Dentistry also provide guidance and oversight to the CoE Director and GIDS Director regarding Data Science initiatives. The CoE also receives advice and feedback from an External Advisory Committee of recognized leaders from the Allen Institute for Artificial Intelligence, Bright House Networks, Cornell University, Harris Corporation, MIT, Microsoft, Wegmans, Xerox, and other leading companies and institutions.